Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, CA 92108-4310

CONTRACT NO. N62473-06-D-2201
CTO NO. 0006

FINAL
PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD DECISION AMENDMENT RADIOLOGICAL ADDENDUM
March 14, 2008

DCN: ECSD-2201-0006-0074

PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

CONTRACT NO. N62473-06-D-2201
CTO NO. 0006

FINAL

PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM

March 14, 2008

PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

DCN: ECSD-2201-0006-0074

TETRA TECH EC, INC.
1230 Columbia Street, Suite 750
San Diego, CA 92101-8536

Bill Dougherty
Project Manager

Cliff Stephan, CHP
Certified Health Physicist

TETRA TECH EC, INC.

TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N62473-06-D-2201 (RAC IV)

Document Control No. ECSD-2201-0006-0074

File Code: 5.0

TO: Contracting Officer
Naval Facilities Engineering Command SW
Ms. Beatrice Appling, AQE.BA
Building 127, Room 108
1220 Pacific Highway
San Diego, CA 92132-5190

DATE: 03/17/08
CTO: 0006
LOCATION: Hunters Point, CA

FROM: A. N. Bolt

A. N. Bolt, Program Manager

DESCRIPTION: Final Parcel B Technical Memorandum in Support of a Record Decision Amendment Radiological Addendum, March 14, 2008. Parcel B

Response to Comments for Draft Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment Radiological Addendum Dated: September 25, 2007 Parcel B, included.

TYPE: ☐ Contract/Deliverable ☒ CTO Deliverable ☐ Notification ☐ Other

VERSION: Final (e.g. Draft, Draft Final, Final, etc.) REVISION #: N/A

ADMIN RECORD: (PM to Identify) Yes ☒ No ☐ Category ☐ Confidential ☐

SCHEDULED DELIVERY DATE: 03/14/08 ACTUAL DELIVERY DATE: 03/17/08

NUMBER OF COPIES SUBMITTED: O/9C/6E Copy of SAP to N. Ancog ☐

COPIES TO: (Include Name, Navy Mail Code, and Number of Copies)

NAVY:		TtEC:	OTHER: (Distributed by TtEC)
C. Mafara (06B2.CK)	O/1C	R. Ahlersmeyer	L. Lowman / M. Slack - RASO
*BPMOW		S. Hernandez	P. Owens - RASO
*K. Forman	1C	C. Stephan	*See Attached Cover Letter for
*M. Kito	1C/1E	Library Copy	Additional Distribution
*D. Knight	1C/1E		
*D. Jensen	1C/1E		Date/Time Received
D. Silva (EVR.DS)	3C/3E		
Basic Contract Files (AQE)			
1C			

EXECUTIVE SUMMARY

The Department of the Navy has prepared this radiological addendum to the Parcel B Technical Memorandum in Support of a Record of Decision Amendment (SulTech, 2007) to address potential radioactive contamination in buildings, fill areas, former building sites, storm drains, and sanitary sewers in Parcel B at Hunters Point Shipyard, a deactivated Department of the Navy shipyard on San Francisco Bay in southeastern San Francisco, California. The overall purpose of this addendum is to provide information to support the future Proposed Plan to modify the final remedy selected for Parcel B in 1997. The modified plan will reflect new information concerning the nature and extent of contamination, including heavy metals, radionuclides, and methane.

The primary purpose of this addendum is to provide decision makers with the information necessary to select a final remedy for radiologically-impacted buildings (103, 113, 113A, 130, 140 and discharge channel, and 146), fill areas (Installation Restoration Sites 07 and 18), soils of former building sites (142 and 157), and soils and piping associated with remediated storm drains and sanitary sewers. This is accomplished through the development and evaluation of appropriate remedial alternatives. The alternatives presented in this document are similar in scope to those identified in the Technical Memorandum in Support of a Record of Decision Amendment (SulTech, 2007). In addition, alternatives are chosen for Parcel B radiologically-impacted buildings. The following general steps were used to achieve this purpose:

1. Development of a conceptual site model that summarizes the Hunters Point Shipyard and Parcel B background, nature of the contaminant release, environmental media impacted, fate and transport of radionuclides of concern in the environment, potential receptors and exposure pathways, and a risk assessment
2. Development of remedial action objectives for radioactively contaminated media
3. Development of general response actions (e.g., institutional controls, excavation, or containment) that may be taken to satisfy the remedial action objectives. The general response actions are similar in scope as those established in the Technical Memorandum in Support of a Record of Decision Amendment (SulTech, 2007) along with additional general response actions for radiologically-impacted Parcel B buildings
4. Identification of radiologically-impacted buildings and sites where general response actions will be applied
5. Identification and evaluation of technology options applicable to each general response action on the basis of their ability to achieve the remedial action objective, technical and administrative implementability, and cost
6. Assembly of the selected representative technologies and process options corresponding to different general response actions to develop a range of remedial alternatives

7. Performance of detailed analysis of remedial alternatives based on seven of the nine evaluation criteria in the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations, Part 300.430 [e] [9][iii])
8. Performance of comparative analysis of alternatives for each of the evaluation criteria to identify the relative advantages and disadvantages of each alternative

Hunters Point Shipyard is a former Department of the Navy shipyard located in the southeast portion of the City of San Francisco, California, situated on a long promontory extending eastward into the San Francisco Bay. The Hunters Point Shipyard property currently consists of approximately 866 acres, about 446 of which are offshore.

The shipyard property is divided into six parcels: B, C, D, E, E-2, and F. Originally the shipyard property included Parcel A that was transferred to the San Francisco Redevelopment Agency in December 2004, and is no longer Department of the Navy property. This radiological addendum focuses on Parcel B only.

Parcel B is located in the northern quadrant of Hunters Point Shipyard. It has multiple buildings (103, 113, 113A, 130, 140 and discharge channel, and 146), two non-engineered fill areas (Installation Restoration Sites 07 and 18), former building sites (142 and 157), storm drains, and sanitary sewers considered radiologically-impacted. Radiological operations within these areas included personnel decontamination, radioactive waste storage, radiography source operations, storage of samples from atomic weapons testing, storage of radioluminescent devices, and discharges of radioactive materials. The two non-engineered fill areas (Installation Restoration Sites 07 and 18) were potentially used for disposal of materials generated during the decontamination of ships that participated in atomic weapons testing and discarding of radioluminescent devices (Naval Sea Systems Command, 2004). The real property transfer table below shows the various buildings, former building sites, and Installation Restoration Sites 07 and 18 along with their redevelopment block number, planned reuses, and exposure scenario.

Building/Site Number	Redevelopment Block	Redevelopment Block Planned Reuse	Reuse Scenario
103	4	Mixed Use	Residential
113	7	Mixed Use	Residential
113A	7	Mixed Use	Residential
130	9, 12	Mixed Use	Residential
140 and discharge channel	16, BOS-3	Educational/Cultural and Open Space	Industrial and Recreational
142 Site	16	Educational/Cultural	Industrial
146	6	Research and Development	Residential
157 Site	15	Mixed Use	Residential
IR Site 07	2, 3, BOS-1	Research and Development, Open Space	Residential and Recreational
IR Site 18	1, 2, BOS-1	Mixed Use, Research and Development, Open Space	Residential and Recreational

BOS – Parcel B Open Space

Most of Parcel B is located in the lowlands, with surface elevations between zero and 10 feet above mean sea level. No threatened or endangered species are known to inhabit Parcel B. The ecology at Parcel B is limited to plant and animal species adapted to an industrial environment. Viable terrestrial habitat is inhibited at Parcel B because about 75 percent of the ground surface is covered by pavement and buildings (SulTech, 2007).

The radionuclides of concern associated with Parcel B include cobalt-60, plutonium-239, cesium-137, radium-226, and strontium-90. Radioluminescent devices were commonly used on all types of Navy ships through the late 1960s. During this time, it was common practice to dispose of the devices in the local landfills or fill areas. The radionuclides associated with radioluminescent devices used on ships are radium-226 and strontium-90. In addition to being used as a Department of the Navy shipyard, Hunters Point Shipyard was home to the Naval Radiological Defense Laboratory whose mission was to study the effects of atomic weapons. Numerous ships that participated in atomic weapons testing from 1946 through the early 1960s were returned to Hunters Point Shipyard for decontamination. The dry docks are known locations of decontamination operations and residues from these operations were potentially disposed of at the shipyard or discharged into the sanitary and storm drain system. The radionuclides associated with the decontamination activities are cobalt-60, plutonium-239, cesium-137, and strontium-90.

The remedial action objectives for radionuclides of concern in Parcel B were developed based on the medium of concern, potential exposure pathways, and applicable or relevant and appropriate requirements. The following radiological remedial action objectives were identified for buildings 103, 113, 113A, 130, 140, and 146, soils of former building sites 142 and 157, fill areas (Installation Restoration Sites 07 and 18); and soils and piping associated with remediated storm drains and sanitary sewers of Parcel B:

- Reduce exposure to incremental concentrations of the radionuclides of concern above naturally occurring levels such that a comprehensive (chemical and radiological) estimated lifetime cancer risk (above background) does not exceed the 10^{-6} to 10^{-4} risk range.
- Reduce exposure to soil from radionuclides of concern exceeding the site-specific cleanup goal (remediation goals).

The following alternatives were identified in the Technical Memorandum in Support of a Record of Decision Amendment and modified to satisfy the remedial action objectives listed above. The alternatives are grouped S for soil, GW for groundwater and R for radiologically-impacted sites.

- Alternative S-1: No Action: For this alternative no remedial action would be taken. The no-action response is retained through the evaluation process as required by the National Oil and Hazardous Substances Pollution Contingency Plan to provide a baseline for comparison with other alternatives.

- Alternative S-2: Institutional Controls, Maintained Landscaping, and Shoreline Revetment: Alternative S-2 consists of institutional controls, maintained landscaping, and construction of a shoreline revetment that, together will meet all applicable or relevant and appropriate requirements and remedial action objectives. The institutional controls include access restrictions and covenants to restrict use of property that will be implemented parcel-wide for all of the redevelopment blocks. The maintained landscaping would prevent potential exposure to asbestos (that may be present in surface soil and transported by wind erosion) that would not be addressed by institutional controls alone. The shoreline revetment would be constructed to protect the entire shoreline for the redevelopment blocks where the revetment is necessary. This alternative includes radiological screening in support of shoreline revetment.

- Alternative S-3: Excavation, Methane and Mercury Source Removal, Disposal, Institutional Controls, Maintained Landscaping, and Shoreline Revetment: Alternative S-3 consists of soil excavation and off-site disposal and maintained landscaping and institutional controls similar to Alternative S-2. Alternative S-3 contains the same maintained landscaping and shoreline revetment components discussed with Alternative S-2. Areas where organic compounds (including the methane source), mercury, and lead are chemicals of concern would be excavated to remediate these chemicals of concern to remediation goals. This alternative would provide a more permanent remedy to remove contaminants where excavation is feasible. Parcel-wide institutional controls would also be applied to mitigate the risk exposure to other chemicals of concern in soil that are not practical to remediate by excavation and disposal. This alternative includes radiological support of the methane source removal and shoreline revetment.

- Alternative S-4: Covers, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment: Alternative S-4 consists of covers to remove the exposure pathway to soil contaminants and institutional controls similar to Alternatives S-2 and S-3. Alternative S-4 also contains the same methane and mercury source removal components described in Alternative S-3 and the shoreline revetment component included in Alternatives S-2 and S-3. This alternative provides physical barriers to cut off the soil exposure pathways at Parcel B. Covers included in this alternative may include new covers and existing or future building footprints, roads, parking lots, and maintained landscaping. Institutional controls are included in this alternative for both short-term and long-term mitigation of risk exposure. In addition to institutional controls similar to those required for Alternative S-2, institutional controls will also be included that would require maintenance of covers. This alternative includes radiological support of the methane source removal and shoreline revetment.

- Alternative S-5: Excavation, Methane and Mercury Source Removal, Disposal, Covers, Soil Vapor Extraction, Institutional Controls, and Shoreline Revetment: Alternative S-5 consists of a combination of soil excavation (including methane and mercury source removal) and off-site disposal, covers, soil vapor extraction for volatile organic compounds, institutional controls, and shoreline revetment. This alternative was developed as a combined alternative to (1) remove and dispose of

organic chemicals of concern, mercury, and lead, as described in Alternative S-3; (2) implement and maintain block-wide covers, as described in Alternative S-4; (3) remove and treat volatile organic compounds in soil using soil vapor extraction; and (4) implement the institutional controls and construct the shoreline revetment, as described in Alternative S-2. This alternative includes radiological support of the methane source removal and shoreline revetment.

- Alternative GW-1: No Action: For this alternative, no remedial action will be taken for groundwater. Groundwater conditions will be left as is, without implementing any response actions. The no-action response is retained throughout the evaluation process as required by the National Oil and Hazardous Substances Pollution Contingency Plan to provide a baseline for comparison with other alternatives.

- Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls: Alternative GW-2 consists of groundwater monitoring and institutional controls. This alternative was developed as a method for monitoring contaminants present at low concentrations in groundwater. Additionally, groundwater monitoring would be used to confirm site conditions and ensure that, over time, the potential exposure pathways remain incomplete. Two groundwater monitoring wells have been installed near well IR26MW47A to monitor concentrations of mercury in groundwater. A third well would be installed within the area of Excavation EE-05 after the final remedy is selected and the mercury source removal is completed. Institutional controls are also included in this alternative to effectively manage risk by preventing exposure and use of the groundwater. Groundwater monitoring for the radionuclides of concerns would be used to confirm site conditions and ensure that, over time, the potential exposure pathway remains incomplete.

- Alternative GW-3A and GW-3B: In-Situ Treatment, Groundwater Monitoring, and Institutional Controls: Alternatives GW-3A and GW-3B consist of in-situ treatment of the contaminant plumes in addition to groundwater monitoring and institutional controls similar to Alternative GW-2. Alternatives GW-3A and GW-3B involve using different in-situ treatment reagents. Alternative GW-3A would use a slow-release substrate designed to promote anaerobic bioremediation to degrade chlorinated chemicals of concern to nontoxic compounds. Alternative GW-3B would use a zero-valent iron slurry as an additive to create a chemically reducing environment in the aquifer that mineralizes chlorinated chemicals similar to the bioremediation reaction. These alternatives were selected to reduce the required time to meet the groundwater remedial action objectives, and as a result, the length of groundwater monitoring and possibly the time required for institutional controls. Groundwater monitoring for the radionuclides of concern would be used to confirm site conditions and ensure that, over time, the potential exposure pathway remains incomplete.

- Alternative R-1: No Action: No remedial action would be taken for radiologically-impacted sites. The no-action response is retained through the evaluation process as required by the National Oil and Hazardous Substances Pollution Contingency Plan to provide a baseline for comparison with other alternatives.

- Alternative R-2: Survey, Decontamination, Disposal, Release, and Institutional Controls: Alternative R-2 consists of decontamination of radiologically-impacted buildings and dismantlement if necessary. Surveys of buildings, soils of former building sites, trenches resulting from sewer and storm line removal, and soils of remediated storm drains and sanitary sewers would be conducted to meet the remedial action objectives. The Building 140 shaft below 10 feet would not be surveyed nor released due to the building's current condition, health and safety hazards, and other uncertainties. Institutional controls would be assigned to the Building 140 shaft below 10 feet and associated piping. Surface scans of Installation Restoration Sites 07 and 18 would include removal of anomalies down to one foot, backfill with clean material to grade, and use of institutional controls.
- Alternative R-3: Survey, Decontamination, Disposal, Release, Close In-Place, and Institutional Controls: Alternative R-3 consists of decontamination of radiologically-impacted buildings and dismantlement if necessary. Surveys of buildings, soils of former building sites, trenches resulting from sewer and storm line removal, and soils of remediated storm drains and sanitary sewers would be conducted to meet the remedial action objectives. This alternative assumes that the Building 140 shaft below 10 feet will not be released. It will be closed in-place with backfilled stone and a concrete cap, and institutional controls will be assigned. Surface scan of Installation Restoration Sites 07 and 18 would include removal of anomalies down to one foot, backfill with clean material to grade, and use of institutional controls.

Each remedial alternative developed in the Technical Memorandum in Support of a Record of Decision Amendment and this addendum was evaluated in comparison to the two threshold and five balancing National Oil and Hazardous Substances Pollution Contingency Plan evaluation criteria. Comparison to the two modifying criteria of regulatory and community acceptance will be included in the final Technical Memorandum in Support of a Record of Decision Amendment report, this addendum, and future proposed plans after comments are received. Further discussion of these criteria is not included in this report. A comparative analysis was then conducted to evaluate the relative performance of the five soil, three groundwater, and three radiologically-impacted sites remedial alternatives developed for Parcel B.

An overall rating was assigned to each alternative. Alternatives S-2 through S-5 meet the threshold criteria. Alternative S-5 is rated excellent overall for the five balancing National Oil and Hazardous Substances Pollution Contingency Plan evaluation criteria. Alternative S-5 is the most effective, with both excavation and covers, although it has the highest cost ($11.4 million). Alternative S-3, rated good, is more effective than Alternative S-2 because contaminants are removed, although it is more expensive ($9.8 million). Alternative S-4, rated very good, is more effective than Alternatives S-2 or S-3 and is similar in cost ($10.9 million) to Alternative S-5. Alternative S-2, rated good, is easiest to implement and least expensive ($5.6 million). Alternatives S-2 will have an additional cost (0.07 million) and S-3 through S-5 will each have an additional cost ($0.55 million) associated with the radiological support required for each alternative. Alternative S-1 is rated as not acceptable.

Alternative GW-3A, rated excellent, has the highest overall rating. The treatment in Alternative GW-3A effectively reduces risks to human health and environment and has a moderate cost ($2.7 million). Alternative GW-3B is rated very good, but the higher cost makes it slightly less advantageous ($3.1 million). Alternative GW-2, rated good, is easy to implement and least expensive ($1.75 million), but it is not as effective as Alternatives GW-3A and GW-3B. Alternatives GW-2 and GW-3A/3B will each have an additional cost ($0.28 million) associated with the radiological sampling required for each alternative. Alternative GW-1 and the original Record of Decision groundwater alternative are rated as not acceptable.

Alterative R-3, rated very good, has the highest overall rating, although it has the highest overall cost ($29.6 million). Alternative R-3 is more effective than Alternative R-2 based on the proposed closure in-place of the Building 140 shaft below 10 feet and associated piping. Alternative R-2 is rated as good with an associated cost of ($28.9 million). However, it is less effective than Alternative R-3 based on the proposed abandonment of the Building 140 shaft below 10 feet and associated piping, relying on institutional controls to mitigate potential risk. Alternative R-1 is rated as not acceptable.

Figure ES-1 summarizes the results of the evaluation.

FINAL
PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT

DATED 12 DECEMBER 2007

THIS RECORD IS ENTERED IN THE DATABASE AND FILED AS

RECORD NO. AR_N00217_001251

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Appendix A	Parcel B Risk Screening Analysis
Appendix B	Remedial Action Alternative Cost Summary Sheets
Appendix C	Applicable or Relevant and Appropriate Requirements
Appendix D	Responses to Comments Received on the Draft Final Parcel B TMSRA Radiological Addendum.

ABBREVIATIONS AND ACRONYMS

§	Section
^{137}Cs	cesium-137
^{3}H	hydrogen-3
^{226}Ra	radium-226
^{239}Pu	plutonium-239
^{60}Co	cobalt-60
^{90}Sr	strontium-90
AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
ARIC	Area Requiring Institutional Controls
BRAC PMO	Base Realignment and Closure Program Management Office West
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CDPH	California Department of Public Health
CFR	Code of Federal Regulations
cm^2	square centimeter
DoD	U.S. Department of Defense
dpm	disintegration per minute
DON	Department of the Navy
DTSC	Department of Toxic Substances Control
EFA WEST	Engineering Field Activity West, Naval Facilities Engineering Command
ELCR	excess lifetime carcinogenic risk
EPA	U.S. Environmental Protection Agency
ESD	explanation of significant difference
FFA	Federal Facility Agreement
GRA	general response action
HPS	Hunters Point Shipyard
HRA	Historical Radiological Assessment
IR	Installation Restoration
LFE	LFE Environmental Analysis Laboratories, Inc.

ABBREVIATIONS AND ACRONYMS
(Continued)

MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCL	maximum contaminant level
mrem/y	millirem per year
msl	mean sea level
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NAVSEA	Naval Sea Systems Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NNPP	Naval Nuclear Propulsion Program
NRC	Nuclear Regulatory Commission
NRDL	Naval Radiological Defense Laboratory
O&M	operation and maintenance
pCi/g	picocurie per gram
PRG	preliminary remediation goal
pt.	Part
RADLAB	Radiation Laboratory
RAO	Remedial Action Objective
RASO	Radiological Affairs Support Office
RESRAD	Residual Radioactivity (Model)
RESRAD-BUILD	Residual Radioactivity-Building (Model)
RG	remediation goal
RMP	Risk Management Plan
ROC	radionuclide of concern
ROD	Record of Decision
RSS	Radiological Safety Section
SFRA	San Francisco Redevelopment Agency
SWRCB	State Water Resources Control Board
TCRA	time-critical removal action
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment
USC	United States Code
Water Board	San Francisco Regional Water Quality Control Board

1.0 INTRODUCTION

This document provides a radiological addendum to the Technical Memorandum in Support of a Record of Decision Amendment (TMSRA) (SulTech, 2007) for Parcel B at Hunters Point Shipyard (HPS), San Francisco, California. The addendum was developed under Remedial Action Contract No. N62473-06-D-2201, Contract Task Order No. 0003 for the Department of the Navy (DON), represented by the Base Realignment and Closure Program Management Office West (BRAC PMO), Naval Facilities Engineering Command, Southwest (NAVFAC SW), and the Radiological Affairs Support Office (RASO). This addendum complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

1.1 PURPOSE

This addendum presents alternatives for radiologically-impacted sites that include remediation of or remedies for radionuclides of concern (ROCs), which are cesium-137 (^{137}Cs), cobalt-60 (^{60}Co), plutonium-239 (^{239}Pu), radium-226 (^{226}Ra), or strontium-90 (^{90}Sr). Radiologically-impacted sites include buildings (103, 113, 113A, 130, 140, 146), former building sites (142 and 157), fill areas (Installation Restoration [IR] Sites 07 and 18), and soils and piping associated with remediation of storm drains and sanitary sewers (Naval Sea Systems Command [NAVSEA], 2004). The former Building 114 site field work and report has been completed and therefore the Building 114 site is excluded from this document. This addendum excludes the dry docks and ship berths in Parcel B. These have been moved into Parcel F. The following guidelines were used for preparation of this addendum:

- *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA; Interim Final* – U.S. Environmental Protection Agency (EPA) Guidance (EPA 540-G-89-004) (EPA, 1988).
- *Technology Screening Guide for Radioactively Contaminated Sites* – EPA Guidance (EPA 402-R-96-017) (EPA, 1996).
- The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Title 40 of the Code of Federal Regulations [CFR], Part 300.430 [40 CFR Part 300]).
- *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, Attachment A, EPA, OSWER Directive 9200.4-18 (EPA, 1997).

The radiological work (surveys and remediation) proposed in this document will be performed and coordinated with the chemical CERCLA work proposed in the TMSRA. This addendum helps to ensure that worker, public, and environmental exposure to radioactivity is as low as reasonably achievable (ALARA) and evaluates the combined chemical and radiological risk.

1.2 ORGANIZATION OF ADDENDUM

This report has been organized into the following sections:

- **Section 1.0: Introduction** – This section presents the purpose of the addendum, guidance documents used for its preparation, and organization of the report.
- **Section 2.0: Parcel B Site History and Characterization** – This section presents the site background, potential sources and mechanisms for release of the radionuclides, environmental media impacted, fate and transport of the radionuclides in the environment, potential receptors, and exposure pathways.
- **Section 3.0: Risk Evaluation Summary and Remediation Goals** – This section presents a summary of the radiological risk to human health based on the conditions in soil, the planned future land uses, and remediation goals for the ROCs (DON 2006). The combined chemical and radiological risk is also presented in this section.
- **Section 4.0: Remedial Action Objectives, General Response Actions, and Process Options** – This section discusses remedial action objectives (RAOs), including identification of applicable or relevant and appropriate requirements (ARARs), and identification and screening of potential general response actions (GRAs) to satisfy the RAOs.
- **Section 5.0: Development and Description of Remedial Alternatives** – This section presents a detailed description of the remedial alternatives based on the process options selected in Section 4.0 that will satisfy the RAOs. Process options recommended for consideration are assembled, singularly or in combination, to create remedial alternatives.
- **Section 6.0: Detailed Analysis of Alternatives** – This section presents a detailed evaluation of alternatives with respect to the evaluation criteria specified in the NCP (40 CFR, Part 300.430[e][9][iii]) to address statutory requirements and preferences of the CERCLA.
- **Section 7.0: References** – This section includes references used to prepare this document.
- **Tables and figures are included following the text.**
- **Appendix A**: Parcel B Risk Screening Analysis presents a detailed discussion of the risks associated implementation of the various alternatives for residual radioactivity.
- **Appendix B**: Remedial Action Alternative Cost Summary Sheets present detailed costs and associated assumptions for each alternative.
- **Appendix C**: ARARs identify and evaluate potential federal and State of California ARARs applicability to the alternatives.
- **Appendix D**: Responses to comments received on the Draft Final TMSRA-RA.

2.0 PARCEL B SITE HISTORY AND CHARACTERIZATION

This section summarizes the site background, potential sources of radiological contamination, nature of release, environmental media impacted, fate and transport of ROCs potentially present at Parcel B, potential receptors, and exposure pathways.

2.1 BACKGROUND

HPS is a former DON shipyard located in the southeast portion of San Francisco, California, situated on a long promontory extending eastward into San Francisco Bay (Figure 2-1). Purchased by the DON in 1939, the HPS property consists of approximately 866 acres, of which 446 are underwater (DON, 2006). The Bayview/Hunters Point district of San Francisco bounds HPS on the north and west, and the San Francisco Bay borders HPS on the south and east. Bayview/Hunters Point is a low-density demographic area where about half the residents own their homes. More than half of the land in Bayview/Hunters Point district is used for industrial purposes. Entrance to the base is gained through the gate at the intersection of Innes Avenue and Donahue Street, adjacent to the Bayview/Hunters Point district. Easily identifiable from a distance by its large gantry crane, HPS lies northeast across a narrow brackish water inlet from Candlestick Point, on the west bank of the Bay, south of the Oakland Bay Bridge.

In 1992, the DON divided HPS into five contiguous parcels (A through E) to expedite remedial action and land reuse. In 1996, the DON added a sixth parcel (Parcel F), also known as the offshore areas. In September 2004, the DON designated the landfill area in Parcel E as a separate parcel, Parcel E-2. Currently, HPS has six parcels: B, C, D, E, E-2, and F. Parcel A was transferred to the San Francisco Redevelopment Agency (SFRA) in December 2004 and is no longer DON property. Figure 2-2 identifies the six parcels at HPS and outlines Parcel B, the focus of this addendum. Figure 2-3 identifies radiologically-impacted buildings, sites of former buildings, and IR Sites 07 and 18 in Parcel B.

An HPS Parcel B Record of Decision (ROD) was approved by the DON on October 7, 1997 (DON, 1997). This document established chemical remedial action objectives and established the depth to which soil would be excavated. Since then two explanations of significant differences (ESD) have been issued modifying the remedy for soil in the ROD. The first ESD in 1998 changed the maximum excavation depth to 10 feet. The second ESD in 2000 updated the chemical cleanup goals for soil.

The DON summarized the first five-year review of the Parcel B ROD in a report dated December 10, 2003 (Tetra Tech EC, Inc., 2003). The review determined that a TSMRA was required to the support changes to the chemical conceptual site model. Additionally, it was determined during the preparation of the TSMRA that an addendum should be included to address the radiological contaminants at the site.

2.1.1 Site Description

Parcel B is located in the northern quadrant of HPS as shown in Figure 2-2. Radiologically-impacted sites in Parcel B were used for personnel barracks, personnel decontamination, radioactive waste storage, general shops, industrial laboratories, maintenance and machine shops, and a location for radioluminescent device collection. Two areas of non-engineered fill (IR Sites 07 and 18) are present in the northwest section of Parcel B. The two areas were evaluated in order to determine whether or not they were potentially used for disposal of radiologically contaminated material and debris associated with the decontamination of ships that participated in atomic weapons testing. It is important to note that no specific documentation has been found suggesting IR-07/18 was used as a disposal site for radiologically contaminated material. Additionally, the HRA identifies the potential for radiological contamination at IR-07/18 as "unlikely", and this determination is supported by the findings of previous investigations. Specific information on the history of decontamination of ships associated with atomic testing and radiological surveys that were conducted at IR Sites 07 and 18 can be found in Section 6 and Appendix D of the HRA. Parcel B includes the shoreline along IR Site 07. The drydocks and ship berths in Parcel B have been excluded and moved to Parcel F. Parcel B boundaries are detailed in Figure 2-3. Section 2.1.1 of the TMSRA provides a discussion on the earlier Parcel B boundary changes.

Parcel B is bounded by other portions of HPS and by San Francisco Bay. Most of the land at Parcel B was formerly part of the industrial support area and was used for shipping, ship repair, offices, housing, and commercial activities. The historical uses of structures and areas at Parcel B are summarized in Table 2-1. According to San Francisco's Redevelopment Plan (SFRA, 1997), once transferred, Parcel B will be subdivided into blocks and zoned for educational/cultural, mixed use, research and development, and open spaces. The city's proposed reuse areas for Parcel B are shown in Figure 2-3.

2.1.2 Site History

The area of San Francisco known as Hunters Point began its relationship with shipbuilding and repair to support the increasing demand for commercial trade and passenger travel brought on by the mid-nineteenth century gold rush. In 1850, the Hunters Point peninsula was approximately 6,000 feet long and 2,000 feet wide, with a maximum elevation of 290 feet. Between 1909 and 1939, the facilities at Hunters Point were owned and operated by a Bethlehem Steel Company subsidiary and used extensively for commercial and military ship maintenance and repair. HPS was originally a deep-water, two dry-dock facility when purchased by the DON in 1939. The DON augmented HPS to a full-service, ship repair and maintenance facility with numerous support buildings, utilities, four additional dry docks, an internal railroad, and living quarters.

Immediately after the end of World War II, the DON used the expansive berthing facilities at HPS for reserve fleet ships returning from the Pacific. In 1946, this berthing and drydocks were used for the radiological decontamination of target and support ships returning from the

OPERATION CROSSROADS atomic tests conducted at Bikini Atoll in the Marshall Islands. HPS also used these facilities for the radiological decontamination of many other ships that participated in subsequent atomic weapons tests (NAVSEA, 2004).

The Chief of Naval Operations recognized the need to study the effects of atomic weapons and ordered an organization known as the Radiological Safety Section (RSS) to be formed at HPS in 1946. The RSS became known as the Radiation Laboratory (RADLAB) and on April 21, 1948, the RADLAB was formalized as the Naval Radiological Defense Laboratory (NRDL) (NAVSEA, 2004). The NRDL conducted various radiological operations at HPS in support of its mission until it closed in 1969. These operations included management of receipt and packaging of radioactive waste for deep sea disposal.

The shipyard functioned as an active DON repair facility from 1939 through 1974. After HPS ceased to function as an operational DON shipyard in 1974, some HPS buildings and structures were leased to private tenants. The largest tenant, Triple A Machine Shop, Inc., conducted ship repair operations throughout HPS from 1976–1986. Various buildings at HPS have also been leased for maritime and non-maritime industrial and artistic purposes. In addition, the DON continued to use some buildings and structures for on-site oversight activities. The DON resumed shipyard operations at a limited number of facilities at HPS in 1986 when HPS was assigned as an annex to Naval Station Treasure Island.

Shipyard operations were permanently terminated on December 29, 1989. In 1991, HPS was placed on the DON's BRAC list and its mission as a DON shipyard ended on April 1, 1994. Engineering Field Activity West, Naval Facilities Engineering Command (EFA WEST), San Bruno, California, had initial oversight of the closure of HPS. After closure of EFA WEST, this oversight authority was transferred to NAVFAC SW in San Diego, California. Currently the DON's BRAC PMO works with NAVFAC SW and RASO to manage the site.

Historical radiological operations included the following (NAVSEA, 2004):

- Repair, use, and disposal of radioluminescent commodity items (dials, gauges, and deck markers)
- Use of radioactive sources for gamma radiography for testing of metal and welds
- Use of radioactive sources for calibration laboratory operations to ensure radiation survey instrument accuracy
- Decontamination of and scientific research on ships contaminated during atomic weapons testing
- Use of various radionuclides for scientific research by the NRDL and its predecessors
- Receipt and packaging of radioactive waste for deep sea disposal

Additionally, Mare Island Naval Shipyard used berthing and drydock facilities at HPS between 1985 and 1989 for non-radiological work on nuclear-powered ships (NAVSEA, 2004).

The radiologically-impacted Parcel B buildings (103, 113, 113A, 130, 140, and 146), former building sites (142 and 157), IR Sites 07 and 18, and storm drains and sanitary sewers and a synopsis of their use are listed in Table 2-1 (NAVSEA, 2004).

2.1.3 Physical Characteristics of the Site

The terrain in the immediate vicinity of Parcel B is relatively flat, with the former Parcel A as the highest point in the area. Most of Parcel B is located in the lowlands, with surface elevations between zero feet to 10 feet above mean sea level (msl). No threatened or endangered species are known to inhabit HPS or its vicinity. There is no viable terrestrial habitat at Parcel B. About 75 percent of the ground surface is covered by pavement and buildings (SulTech, 2007).

Stormwater surface runoff at HPS drains primarily in a sheet-flow pattern from the highlands north and west of Parcel B to the surrounding lowlands. Runoff in Parcel B is collected by the storm drain system and discharged through outfalls to the San Francisco Bay.

The climate is characterized as temperate, or Mediterranean, which typically has moist mild winters and dry cool summers. The average annual precipitation in the area is 21.79 inches (DON, 2006). The precipitation occurs mostly during December, January, and February. The prevailing wind direction is west to east (Brown and Caldwell, 1995). There are public residences within a mile radius of HPS, and the nearest major thoroughfare is Interstate 280, located roughly 5 miles west of the site.

The geology of Parcel B generally consists of a combination of natural and imported fill and undifferentiated sands over Bay Mud over coast-range bedrock (NAVSEA, 2004).

Groundwater under Parcel B and HPS occurs in two aquifers (A- and B-aquifers) and one bedrock water-bearing zone. The A-aquifer is generally unconfined, consisting of a combination of natural and imported unconsolidated fill that overlies the aquitard and bedrock and forms a continuous zone of groundwater across the parcel. Alluvium and colluvium, undifferentiated upper sand deposits, and shallow bedrock also are part of the A-aquifer at various locations across Parcel B (SulTech, 2007).

The B-aquifer consists mainly of undifferentiated sedimentary deposits that overlie bedrock or are contained within the Bay Mud deposits at a few locations near the bay margin. The B-aquifer is not continuous across Parcel B but exists primarily in two separate areas: along the western parcel boundary and in a portion of the central area of the parcel. The B-aquifer ranges in thickness from about 5 to 15 feet where it is present and averages 10 feet thick (SulTech, 2007).

Nearly all the groundwater monitoring wells at Parcel B are screened in the A-aquifer. Only two wells are screened in the B-aquifer, and no wells at Parcel B are screened in the bedrock water-bearing zone (SulTech, 2007).

Water in the A- and B-aquifers generally flows toward the Bay. Groundwater within the A-aquifer is unsuitable for use as a potable water supply (San Francisco Regional Water Quality Control Board [Water Board], 2003).

2.1.4 Parcel B Ongoing Radiological Work

A removal action to address the radiologically-impacted storm drains and sanitary sewers of HPS is currently under progress. The Final Basewide Radiological Removal Action, Action Memorandum (DON, 2006) authorizes a time-critical removal action (TCRA) for the storm drain and sanitary sewer lines. The design plan for the removal of storm drains and sanitary sewers in Parcel B was issued along with a Base-wide plan (Tetra Tech EC, Inc., 2006). A layout of the storm drains and sanitary sewers is included in the design plan and is shown in Figure 2-4. The trenches and soils resulting from the excavation of the storm drains and sanitary sewers are undergoing a Multi-Agency Radiological Site Survey Investigation Manual (MARSSIM) (NUREG-1575; Department of Defense [DoD] et al., 2000) final status survey as part of the TCRA.

Additionally, MARSSIM investigations are being conducted at the former sites of Building 142 and Building 157.

2.1.5 Historical Radiological Assessment and Results

Throughout its history as a DON shipyard, HPS has been assessed for residual contamination from radiological operations. Historically, assessments were performed by the DON and federal agencies. These investigations and surveys of various HPS sites included:

- 1946 through 1948 Radiological Safety Section and NRDL decontaminated and surveyed OPERATION CROSSROADS ships and HPS berths and drydocks. This included areas in Parcel B (NAVSEA, 2004).
- 1955 NRDL surveys to decommission NRDL buildings at HPS (NAVSEA, 2004). There are no reports of surveys for Parcel B NRDL radiologically-impacted sites.
- 1969 NRDL survey for dis-establishment of NRDL (NAVSEA, 2004). There are no reports of surveys for Parcel B NRDL radiologically-impacted sites.
- 1969 to 1970 Atomic Energy Commission (AEC) survey to verify NRDL survey results and release buildings for reuse (NAVSEA, 2004). There are no reports of surveys for Parcel B NRDL radiologically-impacted sites.
- 1974 HPS survey for base closure (NAVSEA, 2004). As part of this activity, buildings 113A and 146 were surveyed for residual contamination and were determined to meet the release criteria of the time (NAVSEA, 2004).

- April 1978 LFE Environmental Analysis Laboratories, Inc. (LFE) survey of Building 815 (NAVSEA, 2004). There are no reports of surveys for Parcel B radiologically-impacted sites.
- July 1978 RASO survey of Building 815 to confirm LFE survey findings (NAVSEA, 2004). There are no reports of surveys for Parcel B radiologically-impacted sites.
- September 1978 RASO survey of former NRDL buildings (NAVSEA, 2004). RASO conducted cursory surveys in Building 113A (NAVSEA, 2004).
- 1979 RASO resurvey of Buildings 364, 815, and 816 (NAVSEA, 2004). There are no reports of Parcel B buildings or areas surveyed (NAVSEA, 2004).
- 1986 EPA harbor survey at Naval Nuclear Propulsion Program (NNPP) request (NAVSEA, 2004). In the HPS drydocks and pier areas, bottom sediment, water, and biological specimens were sampled. The samples focused on ^{60}Co and hydrogen-3 (^{3}H). Survey results detected only naturally occurring radionuclides and trace amounts of ^{137}Cs from fallout (NAVSEA, 2004).
- 1988 to 1989 Harding Lawson Associates site reconnaissance (NAVSEA, 2004). Background surveys were performed elsewhere and surveys of IR-07 were performed. Survey results indicated gamma readings above background levels, but within release limits at that time (NAVSEA, 2004).
- 1991 to 2001 surveys conducted for the Remedial Investigation program in four phases: Phases I through IV, including the following interim investigations (NAVSEA, 2004):
  - Phase I consisted of a surface confirmation radiation survey that included air, soil, and groundwater sampling. The survey was initiated in 1991 to determine and confirm the nature and surficial extent of radium-bearing devices in the disposal area at IR-07, IR-18, and others. At IR-07 and IR-18, gamma activity exceeded the site background value at four locations by more than 50 percent and general area gamma activities were noted. These elevated readings were limited to a small area along/near the Donahue Street boundary. No point source anomalies or devices were identified during the SCRS investigation at IR-07 or IR-18. The Phase I SCRS report recommended that IR07/18 be included in a limited trenching and soil sampling program as part of a Phase II investigation. No anomalies were detected at the shoreline (NAVSEA, 2004).
  - Phase II operations at IR-07/18 included digging of two test pits, one each in IR-07 and IR-18. No point-source radiation anomalies were found at either of these locations. During the trenching activities, the soil associated with the elevated gamma readings was sampled by the Environmental Protection Agency (EPA) in coordination with National Air and Radiation Environmental Laboratory (NAREL), for petrographic analysis to determine the origin of the elevated readings. The results of the analysis indicated that the elevated readings of ^{226}Ra were the result of naturally occurring radioactive material (NORM). The Phase II investigation concluded "no further radiation investigations are recommended for soils in IR07 and IR18 at Parcel B". Further, the report on NORM in soils at

IR07 and IR18 states that the soils at IR07 and IR18 contain NORM including ^{226}Ra. (NAVSEA, 2004).

- Phase III focused on radiological issues related to 1) NRDL operations at HPS, 2) the licensing of general radioactive material use by the Nuclear Regulatory Commission (NRC) in support of NRDL activities, and 3) preliminary findings for buildings and sites used by NRDL in Parcel B. (NAVSEA, 2004).
- Phase IV did not include any survey activities associated with impacted sites in Parcel B
- Phase V, beginning in January 2002, had scoping and characterization surveys performed. Preliminary results were as follows:
  - Building 103 – The Phase V survey was a Class 3 survey and the results were insufficient to support the recommendation of unrestricted use. A Class 1 survey was recommended.
  - Building 113 – The Phase V survey was a Class 3 survey and the results were insufficient to support the recommendation of unrestricted use. A Class 1 survey was recommended.
  - Building 113A – The Phase V survey was a Class 3 survey and the results were insufficient to support the recommendation of unrestricted use. A Class 1 survey was recommended.
  - Building 130 – The Phase V survey was a Class 3 survey and the results were insufficient to support the recommendation of unrestricted use. A Class 1 survey was recommended.
  - Building 146 – A characterization survey was recommended based on additional information uncovered during preparation of the Historical Radiological Assessment (HRA).

Subsequent to the Phase I and II radiological investigations, remedial action excavations were conducted at IR-07/18 pursuant to the 1997 ROD. From 1998 through 2002, over 100,000 cubic yards of soil were excavated and disposed of off-site. A limited amount of abrasive blast material (ABM) likely associated with ship and submarine maintenance, was encountered in IR-07 (excavation 7-5) during these activities. To ensure the safety of onsite personnel, the ABM was submitted for gamma and alpha spectral analysis. The results of these analyses indicated that the ABM posed no radiological hazards (NAVSEA, 2004). The maximum depth of these excavations was 10 feet below ground surface.

2.2 NATURE AND MECHANISM OF RELEASE

The radionuclides listed in Table 2-2 are the ROCs identified for Parcel B (NAVSEA, 2004). The potential sources of contamination were from the handling and refurbishment of radioluminescent devices and decontamination of ships returned from the atomic bomb tests. In addition, contaminants from radioactive sources used to perform non-destructive analysis are potentially present.

Radioluminescent devices were collected from ships prior to scuttling or retiring from service. The devices were consolidated prior to disposal. In Parcel B, Building 146 is known to be a location for radioactive material consolidation and storage. As a fill area, IR-07 and IR-18 could potentially contain radioluminescent devices, as well as sandblasting materials from decontamination and refurbishment activities (NAVSEA, 2004). The atomic bomb tests resulted in uptake of radioactivity in the marine growth on the ship hulls, contamination of the saltwater piping of the ships, and contamination of the fuel oil reserves remaining in the target ships. Many of the contaminated ships were returned to the HPS for decontamination while berthed at the Parcel B piers and dry docks. Additionally, Building 103 was used as a decontamination center for workers decontaminating the OPERATION CROSSROADS ships.

Wet sandblasting, scrubbing, and washing were methods used to decontaminate target and support ships. The sandblast grit and decontamination liquids were initially containerized and buried at sea (NAVSEA, 2004). The contaminated fuel oil was burned in the shore power/steam plants at HPS, which are not located in Parcel B. After December 4, 1946 the sandblast grit was disposed on site and the decontamination liquids were discharged to the bay. It is possible that decontamination materials are present in IR Sites 07 and 18 (NAVSEA, 2004).

Radioluminescent devices were commonly used on ships to allow for viewing of critical control surfaces in low light conditions. Removal, collection, and burial of these devices were commonly performed during ship maintenance operations at HPS. It is likely that radioluminescent devices and paint residues may be present in IR Sites 07 and 18.

Table 2-1 provides the historical uses of structures and areas at Parcel B. For those structures and areas not specifically discussed above the source of contamination is expected to be associated with the activities and uses provided in Table 2-1.

2.3 EXTENT OF RADIOLOGICAL CONTAMINATION

Radiological surveys have been performed on the grounds, buildings, ship berths, and drydocks to assess the extent of contamination and types of radionuclides present. The HPS Final HRA (NAVSEA, 2004) lists structures and areas radiologically-impacted. Table 2-1 of this addendum lists the impacted sites and the radionuclides potentially present.

The designation "radiologically-impacted" means that a site has the potential for radioactive contamination based on historical information or is known to contain radioactive contamination. Assessment of the sites is documented in the HRA (NAVSEA, 2004). The potential for residual radioactive contamination at each impacted site has been determined through an evaluation of historical information, previous radiological survey results, and site reconnaissance. Table 2-3 shows this evaluation of residual radioactivity in Parcel B impacted buildings, structures, and soils.

2.4 RADIONUCLIDE FATE AND TRANSPORT

Radioactive material consists of radionuclides, which are unstable and undergo spontaneous transformations by releasing energy until a stable state is reached. This transformation process is known as radioactive decay and is usually accompanied by the emission of charged particles (e.g., alpha and beta particles) or gamma rays. Alpha particles can travel only short distances and cannot penetrate human skin. Beta particles are generally absorbed in the skin and do not pass through the entire body. Gamma ray radiation can penetrate the human body. Table 2-2 lists the ROCs, their half-lives, and major radiations emitted when decaying (NAVSEA 2004). The radionuclides potentially present in Parcel B were either buried along with excavated fill materials while increasing the footprint of HPS; residue from decontamination of ships or workers; residual contamination as a result of NRDL experiments or tests in structures or land areas; residual contamination from shipyard operations; or released into the sanitary sewers and storm drains.

Each potential ROC is transported through the environment differently. Cobalt typically is not concentrated well by plants and animals. Strontium and radium show a moderate to high degree of food chain transport. Cesium tends to have a high degree of food chain transportability. Plutonium forms insoluble oxides in the environment that are not biologically mobile. In summary, all the ROCs except cesium are fairly immobile once in the soil.

3.0 RISK EVALUATION SUMMARY AND REMEDIATION GOALS

This section summarizes the potential human health risks from exposure to ROCs at Parcel B and presents remediation goals for the identified ROCs. Currently, there is very little data available to accurately and appropriately assess current risk at each radiologically impacted site. At each radiologically impacted building or site, excluding IR-07/18, a combination of scoping, remedial action, and final status surveys, based on MARSSIM methodology, will permit a dynamic approach, where the results of field investigations are used to define and refine the direction of field work and guide cleanup decisions. At IR-07/18, the proposed containment remedy complies with the remedy selection provisions of the NCP at 40 CFR Part 300 as required by CERCLA including the "protectiveness" and "long term effectiveness and permanence" requirements of Sections 300.430(e) and (f).

3.1 EXPOSURE SCENARIOS

The 1997 redevelopment plan gives planned reuses for the entire Parcel B area. Table 3-1 shows the radiologically-impacted areas of Parcel B, the planned reuse, and associated exposure scenario.

The exposure scenario establishes the receptor parameters to be modeled. The potential receptors considered for evaluation were selected to be consistent with the human health risk assessment provided in the TMSRA and are as follows:

- Resident (adult and child)
- Industrial worker (adult)
- Recreational user (adult and child)
- Construction worker (adult)

Although the radiologically-impacted land areas in Parcel B only fall into the residential and recreational exposure scenarios, all four receptor categories listed above were modeled. These additional evaluations provide information on potential risks for all potential reuses, in the event that the redevelopment plan is revised.

3.2 EXPOSURE PATHWAYS

As discussed in the human health risk assessment in the TMSRA, a complete exposure pathway consists of four elements.

- A source and mechanism of chemical release
- A retention or transport medium (or media in cases involving transfer of chemicals)

- A point of potential human contact with the contaminated medium (referred to as the exposure point)
- An exposure route (such as ingestion) at the contact point

If any of these elements are missing (except in a case where the source itself is the point of exposure), then the exposure pathway is considered incomplete. For example, if receptor contact with the source or transport medium does not occur, then the exposure pathway is incomplete and is not quantitatively evaluated for risk. Similarly, if human contact with an exposure medium is not possible, the exposure pathway is considered incomplete and is not evaluated.

For the potentially contaminated structure surfaces the exposure pathways are external radiation from contaminated surfaces and inhalation of re-suspended contaminated dust.

The exposure pathways for the impacted soils at Parcel B present a more complicated analysis. The complete pathways, based on the four criteria listed above, are external radiation, soil ingestion, inhalation, and drinking water ingestion (e.g., groundwater).

3.3 REMEDIATION GOALS

Remediation goals (RGs) are selected to achieve the RAOs. Table 3-2 identifies the RG for each ROC. The soil RGs were derived from the EPA preliminary remediation goals (PRGs) based on an increased lifetime cancer risk not to exceed the risk range of 10^{-6} to 10^{-4} for future use scenarios except for ^{226}Ra, which is based on an agreement with EPA (DON, 2006). The RGs for building and equipment surfaces were based on AEC Reg Guide 1.86 to meet the 25 millirem per year (mrem/y) dose limits of the Nuclear Regulatory Commission. The water RGs were derived from *Radionuclides Notice of Data Availability Technical Document*, (EPA, 2000) by comparing the limits from two criteria and using the most conservative limit.

3.3.1 Constituents of Potential Concern

The ROCs, ^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr, have been associated with Parcel B radiologically-impacted buildings (NAVSEA, 2004). The ROCs, ^{137}Cs, ^{60}Co, ^{239}Pu, ^{226}Ra, and ^{90}Sr, have been associated with Parcel B radiologically-impacted soils (IR Sites 07 and 18, former building sites 142 and 157) (NAVSEA, 2004). This information is summarized in Table 2-1.

3.3.2 Media of Concern

The media of concern are the remaining radiologically-impacted buildings (103, 113, 113A, 130, 140, and 146), soils of former building sites (142 and 157), trenches resulting from sewer and storm line removal, soils of remediated storm drains and sanitary sewers, soils of IR Sites 07 and 18, and groundwater.

3.4 RISK EVALUATION BY REDEVELOPMENT BLOCK

The following sections list the redevelopment blocks and associated evaluation scenario. Figure 2-3 shows the redevelopment blocks, impacted areas and buildings, and planned reuses. The radiologically-impacted sites in Parcel B will be identified in each redevelopment block section. Radiologically-impacted sewer and storm drains are present throughout Parcel B and will not be individually listed for development block. The residential scenario provided the most conservative risk estimate and was therefore used to model the risk from ROCs associated with each redevelopment block.

3.4.1 Redevelopment Block 1

Redevelopment Block 1 is located in the southern portion of IR-18 in the southwestern corner of Parcel B. Past activities at IR-18 may have included burial of contaminated ship decontamination debris containing ^{90}Sr, ^{137}Cs, and ^{239}Pu, burial of radioluminescent devices including sources of ^{226}Ra or ^{90}Sr, and placement of construction debris as fill. At one time there was military housing on Block 1. Redevelopment Block 1 is identified for mixed use and was evaluated using a (Residual Radioactivity) RESRAD residential exposure scenario.

3.4.2 Redevelopment Block 2

Redevelopment Block 2 includes most of IR-18 and the southern portion of IR-07 in the western area of Parcel B. Past activities at IR-07 and IR-18 may have included burial of ship decontamination debris containing ^{90}Sr, ^{137}Cs, and ^{239}Pu, burial of radioluminescent devices including sources of ^{226}Ra or ^{90}Sr, and placement of construction debris as fill. A portion of IR-18 was paved and formerly used for a parking lot. At one time there was housing on Redevelopment Block 2, which is identified for research and development use and was evaluated using a RESRAD residential exposure scenario.

3.4.3 Redevelopment Block 3

Redevelopment Block 3 includes part of IR-07 in the western area of Parcel B. Past activities at IR-07 may have included burial of ship decontamination debris containing ^{90}Sr, ^{137}Cs, and ^{239}Pu, burial of radioluminescent devices including sources of ^{226}Ra or ^{90}Sr, and placement of construction debris as fill. There are no buildings on this block. Redevelopment Block 3 is identified for research and development use and was evaluated using a RESRAD residential exposure scenario.

3.4.4 Redevelopment Block 4

Redevelopment Block 4 includes an area in the south-central portion of Parcel B that is largely not covered by IR sites. Redevelopment Block 4 includes radiologically-impacted Building 103 (submarine barracks and personnel decontamination) with ROCs, ^{90}Sr, ^{137}Cs, and ^{239}Pu.

Redevelopment Block 4 is identified for mixed use. Building 103 was evaluated using a (Residual Radioactivity-Building) RESRAD-BUILD residential exposure scenario.

3.4.5 Redevelopment Block 5

Redevelopment Block 5 is in the west-central portion of Parcel B and is identified for research and development use. It does not include any radiologically-impacted buildings, former building sites, or fill areas, and therefore it was not evaluated.

3.4.6 Redevelopment Block 6

Redevelopment Block 6 is in the north-central portion of Parcel B. Redevelopment Block 6 includes a radiologically-impacted structure, Building 146. Activities in Building 146 included radioactive waste storage and radioluminescent device turn-in/collection. The ROCs are ^{90}Sr, ^{137}Cs, and ^{226}Ra.

Redevelopment Block 6 is identified for research and development use. Building 146 was evaluated using a RESRAD-BUILD residential exposure scenario.

3.4.7 Redevelopment Block 7

Redevelopment Block 7 is in the south-central portion of Parcel B. Redevelopment Block 7 includes radiologically-impacted buildings 113 and 113A. Activities for Building 113 included tug boat maintenance, torpedo storage and overhaul, and sample storage from various atomic weapons testing, and the ROCs are ^{90}Sr, ^{137}Cs, and ^{239}Pu. Activities for Building 113A included torpedo storage, non-destructive testing, and radioactive waste storage, and the ROCs are ^{137}Cs and ^{226}Ra.

Redevelopment Block 7 is identified for mixed use and was evaluated using a RESRAD residential exposure scenario for the soil areas and a RESRAD-BUILD residential exposure scenario for the buildings.

3.4.8 Redevelopment Block 8

Redevelopment Block 8 is in the central portion of Parcel B and is identified for mixed use. It does not include any radiologically-impacted buildings, former building sites, or fill areas and therefore no evaluations were performed.

3.4.9 Redevelopment Block 9

Redevelopment Block 9 is in the north-central portion of Parcel B. A portion of Building 130 is in this block. Activities in this building that may have been sources for contamination include industrial shops and radioactive waste storage. The ROCs are ^{137}Cs and ^{226}Ra. Redevelopment

Block 9 is identified for mixed use. Building 130 was evaluated using a RESRAD-BUILD residential exposure scenario.

3.4.10 Redevelopment Block 12

Redevelopment Block 12 is in the northeastern portion of Parcel B. A portion of Building 130 is in this block. Activities in this building that may have been sources for contamination include industrial shops and radioactive waste storage. The ROCs are ^{137}Cs and ^{226}Ra. Redevelopment Block 12 is identified for mixed use. Building 130 was evaluated using a RESRAD-BUILD residential exposure scenario.

3.4.11 Redevelopment Block 15

Redevelopment Block 15 is in the east-northeastern portion of Parcel B. The former Building 157 site is in this block. Activities that may have occurred in the building are shipyard laboratory, non-destructive testing, radiography, and industrial shops. The ROCs are ^{60}Co, ^{137}Cs, and ^{226}Ra. Redevelopment Block 15 is identified for mixed use. The Building 157 site was evaluated using a RESRAD residential exposure scenario.

3.4.12 Redevelopment Block 16

Redevelopment Block 16 is in the eastern portion of Parcel B. Building 140 and its discharge channel as well as the site of former Building 142 is in this block. An activity in Building 140 that may have been a source for contamination is the pumping of water to the bay from Drydock 3 which was used during the decontamination of ships from atomic testing. The ROCs are ^{90}Sr, ^{137}Cs, ^{226}Ra, and ^{239}Pu. The former Building 142 site activities included high-level sample storage from weapons testing and low-level sample counting. The ROCs are ^{90}Sr, ^{137}Cs, ^{226}Ra, and ^{239}Pu.

Redevelopment Block 16 is identified for educational/cultural use. The former site of Building 142 was evaluated using a RESRAD residential exposure scenario. Building 140 was evaluated using a RESRAD-BUILD residential exposure scenario.

3.4.13 Redevelopment Block BOS-1

Redevelopment Block BOS-1 includes parts of IR-07 and IR-18 and is in the western and northwestern portion of Parcel B. Past activities at IR-07 and IR-18 may have included burial of ship decontamination debris containing ^{90}Sr, ^{137}Cs, and ^{239}Pu, burial of radioluminescent devices including ^{226}Ra or ^{90}Sr, and placement of construction debris as fill. There are no radiologically-impacted buildings on this block.

Redevelopment Block BOS-1 is identified for open space use and was evaluated using a RESRAD residential exposure scenario.

3.4.14 Redevelopment Block BOS-2

Redevelopment Block BOS-2 is in the north-central portion of Parcel B. There are radiologically-impacted berths and drydocks in BOS-2. However, these structures are not addressed in this addendum. Redevelopment Block BOS-2 is identified for open space.

3.4.15 Redevelopment Block BOS-3

Redevelopment Block BOS-3 is in the eastern portion of Parcel B. The radiologically-impacted structures in BOS-3 are the Building 140 discharge tunnel and portions of Drydock 3. The discharge tunnel will be addressed with Building 140 in Block 16 and Drydock 3 is not addressed in this addendum.

Redevelopment Block BOS-3 is identified for open space.

3.5 ANALYSIS OF RADIOLOGICAL DOSE AND RISK

As described above, each radiologically-impacted site described above in each redevelopment block was modeled using either RESRAD or RESRAD-BUILD. Appendix A provides a discussion of the input parameters and modeling results for the radiological dose and risk for each radiologically-impacted site. The results were compared against the increased lifetime cancer risk range of 10^{-6} to 10^{-4} and the 25 mrem/y dose limits. Tables 3-3 and 3-4 provide a summary of the modeling results.

The modeling reported in Appendix A is based on the RGs. Actual calculated dose and risk will be based on field measurements from the final status survey results associated with each radiologically-impacted site. For example the risk calculated for survey units one and two of radiologically-impacted site of former Building 114 were calculated to be $4x10^{-7}$ and $2x10^{-7}$ respectively.

The modeling was performed with conservative input parameters to ensure that uncertainties would be minimized, and a separate set of models and results for uncertainty analysis would not be needed. Uncertainty analysis for the various modeling input parameters, as well as various assumptions required for the modeling, are discussed in Appendix A.

3.6 COMBINED CHEMICAL AND RADIOLOGICAL RISK

Estimates of the lifetime risk of cancer to exposed individuals resulting from radiological and chemical risk assessments may be summed in order to determine the overall potential human health hazard associated with a site (Chapter 10, Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual, EPA/540/1-89/002, December, 1989).

To combine the chemical risk and radiological risk, the same approach used in the TSMRA to calculate chemical risk must be taken, namely, calculating total risk from ROCs inclusive of

background and calculating incremental risk from the ROCs present at levels that do not include background. Of the ROCs for Parcel B only ^{226}Ra is naturally occurring. ^{137}Cs and ^{90}Sr may be present in trace quantities because of fallout resulting from nuclear weapons testing. For the purposes of the radiological modeling the background concentration for the ROCs other than ^{226}Ra are assumed to be essentially zero (i.e., zero picocuries per gram [pCi/g]). The ^{226}Ra background concentration is assumed to be the measured background level of 0.5 pCi/g.

To estimate the total risk from radiologically-impacted buildings, the background concentration of the ROCs is assumed to be zero (i.e., zero disintegrations per minute [dpm]/100 square centimeters [cm^2]). This is a reasonable assumption since none of the ROCs are found in building materials except for ^{226}Ra, which can be found in building material made of earthen materials (i.e., cement, ceramic tiles). However, as a conservative modeling measure, the background concentration of ^{226}Ra in building materials is also assumed to be zero.

The combined total risk (a combination of radiological and chemical total risks) is shown in Table 3-5. The combined incremental risk (a combination of radiological and chemical incremental risks) is shown in Table 3-6.

4.0 REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS, AND PROCESS OPTIONS

The purpose of this section is to identify and screen potentially applicable alternatives for removing, stabilizing, containing, or reducing risk and exposure from the ROCs present in buildings (103, 113, 113A, 130, 140, and 146), soils of former building sites (142 and 157), IR Sites 07 and 18, and trenches, piping, and soils associated with storm drains and sanitary sewers at Parcel B. The identification and screening of alternatives include:

- Development of RAOs for soils and structures for the ROCs identified in Section 3.3.1 above.
- Development of GRAs (e.g., containment and excavation) that may be taken to satisfy the RAOs.
- Delineation of target remediation sites to which GRAs might be applied.
- Identification and evaluation of technologies applicable to each GRA on the basis of their effectiveness to achieve the RAOs, technical and administrative implementability, and cost.

Each of these steps is discussed in the following sections.

4.1 REMEDIAL ACTION OBJECTIVES

RAOs are medium-specific goals for protecting human health and the environment. Each RAO should specify 1) the ROC, 2) the exposure route and receptors, and 3) an acceptable contaminant concentration or range of concentrations for each medium of concern (such as soil and structures). RAOs include both an exposure pathway and a contaminant concentration in a given medium because protectiveness may be achieved in two ways: limiting or eliminating the exposure pathway, or reducing contaminant concentrations.

Separate RAOs are typically developed for human health receptors and for ecological receptors. A chemical focused screening-level ecological risk assessment was performed along the shoreline and the inter-tidal zone and is present in the TMSRA. No ecological RAOs were developed because most of the land is paved and the parcel contains no identified terrestrial habitat (SulTech, 2007).

The RAOs for radiologically-impacted sites are as follows:

- Prevent ingestion, dermal contact, or inhalation of ROCs in concentrations that significantly exceed background concentrations.
- Assure that the total effective dose from radiologically-impacted sites to any member of the public does not exceed 25 mrem/y.

- Ensure that the increased lifetime cancer risk does not exceed the risk range of 10^{-6} to 10^{-4} for future-use scenarios.

The NCP provides a range of cancer risks from 10^{-6} to 10^{-4} for the DON as lead agency along with its regulatory partners to use when making decisions on remedies for contaminated sites. Cancer risks less than 10^{-6} (one in a million) are not considered to warrant a cleanup response. Cancer risks greater than 10^{-4} (one in a ten thousand) excess cancer risk warrant action to reduce exposure. NCP §300.430(e)(2)(A) provides factors that must be considered when making decisions regarding remedial action objectives (RAOs) and remedial alternatives in the context of the NCP Risk Management Range as follows:

> Preliminary remediation goals for carcinogens are set at a 10^{-6} excess cancer risk as a point of departure, but may be revised to a different risk level within the acceptable risk range based on the consideration of appropriate factors including but not limited to exposure factors, uncertainty, and technical limitations (NCP preamble at 55 Fed. Reg. 8717, March 8, 1990).

There is a high level of confidence that the cancer risks are representative of the site conditions and the decisions at the 10^{-4} risk level may be acceptable.

4.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d)(l) of CERCLA requires remedial actions attain (or the decision document must justify the waiver of) any ARAR that includes environmental regulations, standards, or criteria promulgated under federal or more stringent state laws. An ARAR may be either applicable or relevant and appropriate, but not both.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site. A requirement must be determined to be both relevant and appropriate to be considered an ARAR.

Section 121(e) of CERCLA exempts any response action conducted entirely on site from having to obtain a federal, state, or local permit when the action is carried out in compliance with

Section 121. In addition, on-site actions need only comply with the substantive requirements of ARARs, and not with the corresponding administrative procedures, such as administrative reviews and record-keeping requirements. Off-site actions must comply with all legally applicable requirements, both substantive and administrative.

The identification of ARARs is based on site-specific factors, including potential remedial actions, chemicals and compounds found at the site, physical characteristics of the site, and the location of the site. ARARs are usually divided into three categories: chemical-specific, location-specific, and action-specific.

As the lead federal agency, the DON has primary responsibility for identification of potential ARARs for HPS Parcel B. The final identification of ARARs will be in the amended ROD. EPA guidance recommends that the lead federal agency consult with the state when identifying potential state ARARs for remedial actions (EPA, 1988). In conjunction with amending the ROD, the DON requested that the state identify potential ARARs in October 2003. On December 24, 2003, Department of Toxic Substances (DTSC) responded and identified potential state ARARs. This response also included potential state ARARs identified by the Department of Fish and Game and the California Department of Public Health (CDPH). The Water Board also submitted a response that identified potential state ARARs for remediation of soil and groundwater. To qualify as a state ARAR under CERCLA and the NCP, a state requirement must be 1) a standard, requirement, criterion, or limitation under a state environmental or facility siting law; 2) promulgated (of general applicability and legally enforceable); 3) substantive (not procedural or administrative); 4) more stringent than the federal requirement; 5) identified by the state in a timely manner; and 6) consistently applied. Requirements identified by these state agencies that the DON identified as potential ARARs are presented in Appendix C.

The sections below summarize the potential federal and State of California radiological ARARs. The non-radiological ARARs are discussed in Section 4.2 of the Parcel B TMSRA.

4.2.1 Potential Chemical-Specific ARARs

Chemical-specific ARARs are health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical cleanup values. Chemical-specific ARARs for soil and structures are described in Table 4-1 and summarized below.

4.2.1.1 Groundwater

Section 4.2.1.1 of the TMSRA discusses potential federal and state chemical-specific ARARs for groundwater. The discussion includes the federal maximum contaminant levels (MCLs) promulgated by EPA under the Safe Drinking Water Act. This addendum specifically includes 40 CFR Section (§) 141.66 MCLs for radionuclides.

4.2.1.2 Surface Water

Section 4.2.1.2 of the TMSRA discusses potential ARARs associated with surface waters. No additional ARARs for surface waters are included in this addendum.

4.2.1.3 Soil

Section 4.2.1.3 of the TMSRA discusses potential federal chemical-specific ARARs for soil. Parcel B contains radiologically-impacted soil, therefore; ARARs are included for soil. No federal requirements for radioactive material are applicable. However, the substantive provisions of the following potential radiation-specific requirements were identified as potentially relevant and appropriate for the remediation of soil and solid waste containing radioactive material at the site:

- Radiation Dose Limits for Individual Members of the Public (10 CFR § 20.1301)
- Standards for Protection Against Radiation (10 CFR 20.1402)
- Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites at 40 CFR § 192.12(a)

In response to comments provided by DPH, provided under the authority of DTSC as a Federal Facility Agreement (FFA) signatory, on the Draft Final TMSRA-RA, the Navy has evaluated the "restricted release" provisions at 10 CFR Section 20.1403(e). The "restricted release" provisions of NRC regulations at 10 CFR Section 20.1403(e) establish maximum value "dose caps" on Total Effective Dose Equivalent ("TEDE") when ICs at a site are "no longer in effect." A "dose cap" of 100 mrem/y is established unless certain additional conditions are satisfied that would support a "dose cap" of 500 mrem/y. As part of this analysis, the requirements of 10 CFR Section 20.1403 in its entirety were evaluated as potential chemical-specific federal ARARs. This evaluation included comparison of the PRGs presented in Table 3-2 to the criteria established in 10 CFR Section 20.1403. The PRGs and remedial actions for Parcel B are protective of human health and the environment and are more stringent and protective than the criteria in 10 CFR § 20.1403. Therefore, the requirements of 10 CFR Section 20.1403 have not been carried forward for further analysis as a potential CERCLA chemical-specific federal ARAR.

The State requirements are not more stringent than federal ARARs, and hence could not be potential ARARs even if they had been identified by the State as State ARARs.

4.2.1.4 Air

Section 4.2.1.4 of the TMSRA discusses potential ARARs associated with air emissions. No additional ARARs for air emissions are included in this addendum.

4.2.1.5 Structures

Parcel B has structures (i.e., buildings) that are radiologically-impacted; therefore ARARs are included radiologically-impacted structures. No federal requirements for radioactive material are potentially applicable. However, the substantive provisions of the following potential radiation-specific requirements were identified as potentially relevant and appropriate for the remediation of radiologically-impacted structures:

- Radiation Dose Limits for Individual Members of the Public (10 CFR § 20.1301)
- Standards for Protection Against Radiation (10 CFR 20.1402)
- Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites at 40 CFR § 192.12(a)

4.2.2 Potential Location-Specific ARARs

Section 4.2.2 of the TMSRA discusses potential federal location-specific ARARs. No additional location-specific ARARs are included in this addendum.

4.2.3 Potential Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements or limitations for remedial activities. These requirements are triggered by the specific remedial activities conducted at the site and indicate how a selected remedial alternative should be achieved. The DON has identified potential action-specific ARARs for radiologically-impacted soil and structural alternatives evaluated in this addendum. These action-specific ARARs supplement the action-specific ARARs discussed in Section 4.2.3 of the TMSRA.

4.2.3.1 Soil Alternatives

Remedial alternatives evaluated for Parcel B soil include the following types of actions for radioactive material remediation, as discussed in more detail in Section 5.0: 1) no action, 2) institutional controls; 3) excavation (removal of the storm drains and sanitary sewers) and institutional controls; 4) covering and institutional controls, and 5) excavation, covers, and institutional controls. The following discussion summarizes potential radiological ARARs for these actions.

Institutional Controls

The DON has identified the substantive provisions of state requirements as potential relevant and appropriate ARARs for institutional controls. The specific institutional control objectives are included in Section 5.0 with the discussion of each alternative. The ARARs for institutional controls for radioactive material are found in Section 4.2.3.1 of the Parcel B TMSRA (SulTech, 2007).

Excavation

The DON has identified that the substantive provisions of federal and state requirements as potential ARARs for excavation of soil and other wastes generated during implementation of the alternatives are the same for chemicals and radionuclides. These ARARs are found in Section 4.2.3.1 of the Parcel B TMSRA (SulTech, 2007).

Covers for the Soil

The DON has identified that the substantive provisions of federal and state requirements as potential ARARs for constructing the shoreline revetment and covering the soil during implementation of the alternatives are the same for chemical and radionuclides. These ARARs are found in the Parcel B TMSRA, Section 4.2.3.1, except for the following requirements, CCR tit. 27 § 20200(c) and State Water Resources Control Board (SWRCB) Order 99-08-DWQ, which are fully explained in Appendix C of this Addendum.

4.2.3.2 Structures

Remedial alternatives evaluated for Parcel B radiologically-impacted structures include the following types of actions: 1) no action; and 2) survey, decontamination, disposal, and release to the remediation goals in Table 3-2. The substantive provisions of the following potential radiation-specific requirements were identified as potentially relevant and appropriate for radiologically-impacted structures:

- Radiation Dose Limits for Individual Members of the Public (10 CFR § 20.1301)
- Standards for Protection Against Radiation (10 CFR § 20.1402)

4.3 GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS ANALYSES

GRAs describe those actions that will satisfy RAOs for both soil and structures. Unlike non-radioactive hazardous substances, which have the ability to be altered by physical, chemical, or biological processes that can reduce or destroy the hazard itself, radioactive substances generally cannot be similarly altered or destroyed. Since destruction of radioactivity is not an option, response actions at radioactively contaminated sites use the concepts of "Time, Distance, and Shielding." Time allows the natural decay of the radionuclide to take place, resulting in reduction in risk to human health and the environment. Distance and shielding from the radioactive material rapidly reduce the risk from radiation by reduction of the intensity of the imparted energy (EPA, 1996). A process option is defined as a specific technology used to carry out a general response action. The following GRAs have been identified for Parcel B:

Soil

- *No Action:* Under this GRA, no further response action will be conducted at the site.

- *Institutional Controls:* These include non-engineered methods such as administrative and/or legal controls that minimize the potential for human exposure to contaminated material by limiting land or resource use and that protect the integrity of remedial action.
- *Containment:* This GRA includes construction of a physical barrier (distance/shielding) to eliminate or reduce the possibility of contaminant migration and exposure. This action also includes renovating and maintaining existing Parcel B covers.
- *Removal/Disposal:* This GRA includes soil remediation, excavation of radioactively contaminated soil, screening to segregate soil exceeding the remediation goals (Table 3-2), and disposal at an appropriate off-site waste disposal facility. Ongoing work at HPS currently includes removal and disposal of the storm drain and sanitary sewer lines.

Structures

- *No Action:* Under this GRA, no further response action will be conducted at the site.
- *Removal/Disposal:* This GRA includes building remediation/demolition, excavation of radioactivity exceeding the remediation goals (Table 3-2), and disposal at a licensed off-site waste disposal facility.

4.4 ANALYSIS OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS

General response actions selected for this Radiological Addendum to the TMSRA underwent an initial screening and analysis. During the initial screening, the range of technology types and process options were evaluated in terms of technical implementation, site conditions, waste characteristics, contaminant properties, and the ability to meet NCP requirements and RAOs. The results of the initial screening are summarized in Tables 4-2, 4-3, and 4-4. The GRAs and process options carried forward from the initial screening were then analyzed in terms of effectiveness, implementability, and cost. The screening and analysis of GRAs and process options is presented separately for soil and structures in Table 4-5.

4.4.1 Evaluation of Applicable Soil Process Options

Potentially applicable GRAs identified for soil at Parcel B consist of 1) no action, 2) institutional controls, 3) removal, and 4) containment. The initial screening of process options for the remedial technology types for these GRAs is shown in Table 4-2. This table presents the various technology types, process options, and results of the screening analysis for each GRA for soil. The rationale for those options eliminated from further evaluation is presented in Table 4-2; these options are not discussed further.

All four GRAs are retained for further evaluation, including no action. The majority of the GRA for treatment was eliminated during the initial screening of process options for soil at Parcel B. Only soil screening, institutional controls, and containment were retained for evaluation.

Those process options retained during the initial screening were evaluated for effectiveness, implementability, and cost, and are discussed in this section. Table 4-2 summarizes the results for this evaluation.

4.4.1.1 No Action

The NCP requires that the no-action alternative be carried through the detailed analysis of alternatives. Under the no-action response, no remedial action is taken. Soil would be left as is without implementing any institutional controls, containment, removal, treatment, or other mitigating actions. Because soil at Parcel B poses a risk to human health and the environment under the anticipated future land-use scenario, the no-action response would not be an effective alternative that meets the requirements of CERCLA. No cost is associated with this option because no action is taken. The no-action option will be retained for further evaluation as a remedial alternative for comparison only, as required under the NCP.

4.4.1.2 Institutional Controls

The following activity restriction requirements shall apply in the Area Requiring Institutional Controls (ARIC) for potential radionuclides located on IR Sites 7 and 18 and the deep pump shaft under Building 140 (see Figure 2-3) in addition to those generally applicable land use restrictions specified in Section 4.3.2.1 of the TMSRA. At the time of transfer, the areas that require this restriction will be surveyed to define the legal metes and bounds for inclusion in the property transfer documents.

The Parcel B Risk Management Plan (RMP) described in the TMSRA, Section 4.3.2.1 (Sultech, 2007) shall address any necessary additional soil and radiological management issues within the ARIC for potential radionuclides designated in Figure 2-3 and defined in the property transfer documents.

For excavations at IR Sites 7 and 18 that are solely in clean fill, e.g. the fill that is placed above the physical or visual barrier (the barrier) which will be placed directly on top of the soils as detailed in the Remedial Design or other appropriate documents, the Parcel B RMP will list the procedures to be followed to be sure that the barrier is not disturbed or breeched. No radiological sampling and analysis will be required for excavations that are solely in clean fill.

For any excavation into the IR Sites 7 and 18 soils beneath the barrier, the proposed excavation will be required to be described in a work plan that will include but not be limited to a radiological work plan, soil sampling and analysis requirements, and a plan for off-site disposal of any excavated radionuclides by the transferee in accordance with federal and state law. This work plan must be submitted to and approved by one or more FFA Signatories in accordance with procedures (including dispute resolution procedures) and timeframes that will be set forth in the RMP. The integrity of the cover/cap must be restored upon completion of excavation as provided in the Parcel B RMP. A completion report describing the details of the implementation

of the work plan, the sampling and analysis, the off-site disposal, and the restoration of the integrity of the cover/cap must be submitted to and approved in writing by one or more FFA Signatories in accordance with procedures (including dispute resolution procedures) and timeframes that will be set forth in the RMP.

4.4.1.3 Removal

Removal is an effective process option for soil at Parcel B and involves removing and transporting contaminated material off site to a licensed disposal facility. Important considerations with the removal and disposal process option include excavation volume, fugitive emissions, hauling distance, and disposal facility for final deposition. Excavations will be to a depth that a calculated excess lifetime carcinogenic risk (ELCR) not to exceed the 10^{-6} to 10^{-4} range. The excavation cleanup criteria would be specific to the reuse type and ROC-specific RAOs specified in Section 4.1.

Excavation is effective and implementable for many of the ROCs found in soil at Parcel B and therefore excavation and off-site disposal process options will be retained for development and evaluation of remedial alternatives.

4.4.1.4 Containment

Containment processes are intended to isolate the contaminated soil or sediment to prevent direct exposure and contaminant migration. The most appropriate containment process options for soil at Parcel B are surface covers. Cover materials used to prevent direct exposure may include clean soil, asphalt, or concrete, and the material to be used will depend on the planned reuse associated with each redevelopment block.

The general approach for implementing covers includes:

> Where covers are needed, areas will be covered with a durable material that will not break, erode, or deteriorate such that the underlying soil becomes exposed. Standard construction practices for roads, sidewalks, and buildings would likely be adequate to meet this performance standard. All covers must achieve a full cover over the entire redevelopment block that ensures an ELCR does not exceed the 10^{-6} to 10^{-4} risk range. The exact nature and specifications for covers can vary from block to block, but all covers must meet the performance standard of preventing exposure to soil and being durable.

All existing or newly installed covers will need to be maintained. Maintenance includes inspections and repairs for covers left in place during future land use and replacement of covers if future land use requires excavation or demolition of the covers during construction. Any modification of existing hardscape will be subject to the institutional controls described earlier.

The process option of covers is effective, so long as the covers are properly installed and maintained and are replaced after excavation or demolition during redevelopment. The implementability and cost of covers are expected to be moderate because they are already in place at most of the redevelopment blocks at Parcel B.

The most appropriate containment process option for sediment is a shoreline revetment. The revetment includes two key features that allow it to isolate contaminated sediment: 1) a geomembrane to prevent migration of fine-grained sediment into the Bay, and 2) an erosion-control element such as riprap, gabions, articulated concrete mat, or concrete structure. The shoreline revetment would be constructed to protect the entire shoreline for the redevelopment blocks where the revetment is necessary. Similar to soil covers, the revetment will need to be maintained, inspected, and repaired, as needed. This process option is effective and has moderate implementability and cost.

The cover and the shoreline revetment process options will be retained for development and evaluation of remedial alternatives. Additional shoreline revetment information may be found in the TMSRA (SulTech, 2007).

The implementability evaluation focused on technical, as well as institutional aspects of implementability, such as the ability to obtain necessary permits and approvals, availability of equipment and skilled workers, extensiveness of knowledge required to implement the process option, and the need for treatment or disposal of process waste.

The cost evaluation included semi-quantitative analysis based on engineering judgment and the unit costs given in the TMSRA (SulTech, 2007).

4.4.2 Evaluation of Applicable Groundwater Process Options

Potentially applicable GRAs identified for groundwater at Parcel B consist of 1) no action, 2) institutional controls, 3) monitoring, 4) treatment, 5) removal, and 6) containment. The initial screening of process options for the remedial technology types for these groundwater GRAs is shown in Table 4-3. This table presents the various technology types, process options, and results of the screening analysis for each groundwater process option. Treatment, removal, and containment of groundwater were not retained after the initial screening based on difficulty of implementation and poor effectiveness.

4.4.2.1 No Action

The NCP requires that the no-action alternative be carried through the detailed analysis of alternatives. Under the no-action response, no remedial action is taken. Impacted structures would be left as is without implementing any survey or decontamination. Because impacted structures at Parcel B may pose a risk to human health and the environment under the anticipated future land-use scenario, the no-action response would not be an effective alternative that meets

the requirements of CERCLA. No cost is associated with this option because no action is taken. The no-action option will be retained for further evaluation as a remedial alternative for comparison only, as required under the NCP.

4.4.2.2 Institutional Controls

As previously discussed in Section 4.4.1.2 institutional controls will be used to implement land use and access restrictions used to limit the exposure of future landowner(s) and/or user(s) of the property to hazardous substances and to maintain the integrity of the remedial action until remediation is complete and remediation goals have been achieved. Section 4.3.2.2 of the TMSRA provides a discussion of institutional controls relative to groundwater.

4.4.2.3 Groundwater Monitoring

Groundwater monitoring for the ROCs will be used to confirm site conditions and ensure that, over time, the potential exposure pathway remains incomplete.

4.4.3 Evaluation of Applicable Structure Process Options

Potentially applicable GRAs identified for impacted structures at Parcel B consist of 1) no action; and 2) survey, decontamination, and release to meet the remediation goals listed in Table 3-2. The initial screening of process options for the remedial technology types for these GRAs is shown in Table 4-4.

4.4.3.1 No Action

The NCP requires that the no-action alternative be carried through the detailed analysis of alternatives. Under the no-action response, no remedial action is taken. Impacted structures would be left as is without implementing any survey or decontamination. Because impacted structures at Parcel B may pose a risk to human health and the environment under the anticipated future land-use scenario, the no-action response would not be an effective alternative that meets the requirements of CERCLA. No cost is associated with this option because no action is taken. The no-action option will be retained for further evaluation as a remedial alternative for comparison only, as required under the NCP.

4.4.3.2 Survey of Impacted Sites

A MARSSIM (NUREG-1575; DoD et al., 2000) radiological survey would be performed on all impacted sites. The impacted sites would be divided into survey units and any ROCs at or above Table 3-2 remediation goals would be remediated.

4.4.3.3 Scabbling and Demolition

Scabbling is defined as roughly dressing rock (in this case building wall, floors, ceilings) and this process would be accomplished using powered mechanical tools. Demolition could include destruction of structure areas or the entire structure found to have ROCs above the cleanup goals. These processes would be followed by more surveys to prove that ROCs above the Table 3-2 remediation goals are eliminated.

5.0 DEVELOPMENT AND DESCRIPTION OF REMEDIAL ALTERNATIVES

The remedial action alternatives for ROCs at Parcel B were developed by combining different technologies and process options corresponding to different GRAs. The target remediation areas were also considered while developing the alternatives. This process ensured the development of a range of alternatives from those involving removal of radiologically contaminated soil, groundwater, or structures posing unacceptable risk to human health to those involving little or no treatment but providing protection to human health by minimizing exposure to the remaining ROCs of Parcel B. The alternatives include:

5.1 DEVELOPMENT OF REMEDIAL ALTERNATIVES

Process options were developed and screened as described in Section 4.0. The retained process options were combined into remedial alternatives to meet RAOs and to satisfy ARARs. The remedial alternatives were derived using experience and engineering judgment to formulate process options into the most plausible site-specific remedial actions.

The DON's strategy for groundwater remedial alternatives is to eliminate complete exposure pathways to the potential receptors and to monitor the known affected areas while the aquifer recovers. Various institutional controls are included in the remedial alternatives for groundwater to assure that the RAOs and ARARs are satisfied.

The DON's strategy for radiologically-impacted buildings remedial alternatives is to eliminate complete exposure pathways to the potential receptors to assure that the RAOs and ARARs are satisfied. The DON's strategy for radiologically-impacted soil remedial alternatives is to remove the contaminated soils from former building sites, trenches resulting from sewer and storm line removal, soils from remediated storm drains and sanitary sewers, and soils from IR Sites 07 and 18 by excavation and disposal wherever practicable and to prevent exposure to soils that cannot be completely removed by eliminating complete exposure pathways to the receptors. Soil covers will eliminate exposure to potential unacceptable risk identified by the radiological human health risk assessment. Covers will use existing materials (rehabilitated as necessary) and newly installed materials to eliminate exposure. Various institutional controls are also integrated with each alternative to assure that the RAOs and ARARs are satisfied.

Both soil and groundwater remedial alternatives include five-year reviews of institutional controls to confirm that the remedies are continuing to protect human health and the environment. Costs for five-year reviews, as well as other long-term activities, are included in the cost estimates for all alternatives.

The alternatives developed for further analysis for soil, groundwater, and buildings are presented in the following sections.

5.1.1 Alternatives Developed for Soil

Section 5.1.1 of the TMSRA discusses the alternatives developed for soils which are summarized below.

Alternative S-1: No Action

For this alternative, no remedial action would be taken. Soil would be left in place without implementing any response actions. The no-action response is retained throughout the evaluation process as required by the NCP to provide a baseline for comparison with other alternatives.

Alternative S-2: Institutional Controls, Maintained Landscaping, and Shoreline Revetment

Alternative S-2 consists of institutional controls, maintained landscaping, and construction of a shoreline revetment that, together, will meet all applicable or relevant and appropriate requirements and remedial action objectives. The institutional controls include access restrictions and covenants to restrict use of property that will be implemented parcel-wide for all of the redevelopment blocks. The maintained landscaping would prevent potential exposure to asbestos (that may be present in surface soil and transported by wind erosion) that would not be addressed by institutional controls alone. The shoreline revetment would be constructed to protect the entire shoreline for the redevelopment blocks where the revetment is necessary. This alternative includes radiological screening in support of shoreline revetment.

Alternative S-3: Excavation, Methane and Mercury Source Removal, Disposal, Maintained Landscaping, Institutional Controls, and Shoreline Revetment

Alternative S-3 consists of soil excavation and off-site disposal and maintained landscaping and institutional controls similar to Alternative S-2. Alternative S-3 contains the same maintained landscaping and shoreline revetment components that are discussed with Alternative S-2. Areas where organic compounds (including the methane source), mercury, and lead are chemicals of concern would be excavated to remediate these chemicals of concern to remediation goals. This alternative would provide a more permanent remedy to remove contaminants where excavation is feasible. Parcel-wide institutional controls would also be applied to mitigate the risk exposure to other chemicals of concern in soil that is not practical to remediate by excavation and disposal. This alternative includes radiological support of the methane source removal and shoreline revetment.

Alternative S-4: Covers, Methane and Mercury Source Removal, Disposal, Institutional Controls, and Shoreline Revetment

Alternative S-4 consists of covers to remove the exposure pathway to soil contaminants and institutional controls similar to Alternatives S-2 and S-3. Alternative S-4 also contains the same methane and mercury source removal components described in Alternative S-3 and the shoreline revetment component included in Alternatives S-2 and S-3. This alternative provides physical barriers to cut off the soil exposure pathways at Parcel B. Covers included in this alternative may include new covers and existing or future building footprints, roads, parking lots, and maintained landscaping. Institutional controls are included in this alternative for both short-term and long-term mitigation of risk exposure. In addition to institutional controls similar to those required for Alternative S-2, institutional controls will also be included that would require maintenance of covers. This alternative includes radiological support of the methane source removal and shoreline revetment.

Alternative S-5: Excavation, Methane and Mercury Source Removal, Disposal, Covers, Soil Vapor Extraction, Institutional Controls, and Shoreline Revetment

Alternative S-5 consists of a combination of soil excavation (including methane and mercury source removal) and off-site disposal, covers, soil vapor extraction for volatile organic compounds, institutional controls, and shoreline revetment. This alternative was developed as a combined alternative to 1) remove and dispose of organic chemicals of concern, mercury, and lead, as described in Alternative S-3; 2) implement and maintain block-wide covers, as described in Alternative S-4; 3) remove and treat volatile organic compounds in soil using soil vapor extraction; and 4) implement the institutional controls and construct the shoreline revetment, as described in Alternative S-2. This alternative includes radiological support of the methane source removal and shoreline revetment.

5.1.2 Alternative Developed for Groundwater

Section 5.1.2 of the TMSRA discusses the groundwater alternatives summarized below.

Alternative GW-1: No Action

For this alternative, no remedial action will be taken for groundwater. Groundwater conditions will be left as is, without implementing any response actions. The no-action response is retained throughout the evaluation process as required by the NCP to provide a baseline for comparison with other alternatives.

Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls

Alternative GW-2 consists of groundwater monitoring and institutional controls. This alternative was developed as a method for monitoring contaminants present at low concentrations in groundwater. Additionally, groundwater monitoring would be used to confirm site conditions

and ensure that, over time, the potential exposure pathways remain incomplete. Two groundwater monitoring wells have been installed near well IR26MW47A to monitor concentrations of mercury in groundwater. A third well would be installed within the area of Excavation EE-05 after the final remedy is selected and the mercury source removal is completed. Institutional controls are also included in this alternative to effectively manage risk by preventing exposure and use of the groundwater. Groundwater monitoring for the ROCs would be used to confirm site conditions and ensure that, over time, the potential exposure pathway remains incomplete.

Alternatives GW-3A and GW-3B: In-Situ Treatment, Groundwater Monitoring, and Institutional Controls

Alternatives GW-3A and GW-3B consist of in-situ treatment of the contaminant plumes in addition to groundwater monitoring and institutional controls similar to Alternative GW-2. Alternatives GW-3A and GW-3B involve using different in-situ treatment reagents. Alternative GW-3A would use a slow-release substrate designed to promote anaerobic bioremediation to degrade chlorinated chemicals of concern to nontoxic compounds. Alternative GW-3B would use a zero-valent iron slurry as an additive to create a chemically reducing environment in the aquifer that mineralizes chlorinated chemicals similar to the bioremediation reaction. These alternatives were selected to reduce the required time to meet the groundwater remedial action objectives, and as a result, the length of groundwater monitoring and possibly the time required for institutional controls. Groundwater monitoring for the ROCs would be used to confirm site conditions and ensure that, over time, the potential exposure pathway remains incomplete.

5.1.3 Alternative Developed for Radiologically-Impacted Sites

The following alternatives were developed for radiologically-impacted sites in Parcel B.

Alternative R-1: No Action

No remedial action would be taken for radiologically-impacted sites. The no-action response is retained through the evaluation process as required by the NCP to provide a baseline for comparison with other alternatives.

Alternative R-2: Survey, Decontamination, Disposal, Release, and Institutional Controls

Alternative R-2 consists of decontamination of radiologically-impacted buildings and dismantlement if necessary; survey of buildings, except for Building 140, soils of former building sites, trenches resulting from sewer and storm line removal, and soils of remediated storm drains and sanitary sewers to meet the remedial action objectives; and surface scan of IR Sites 07 and 18 with removal of anomalies down to one foot, backfill with clean material to grade, installation of a semi-engineered two-foot soil cap above original grade, and use of institutional controls. The cap comprises an engineering control placed on top of a demarcation

layer (durable fence mesh demarking the bottom of the two foot soil cap). The above-grade portions of Building 140, the discharge tunnel, and first 10 feet of the Building 140 shaft would be surveyed to verify that no residual radioactivity is present above the RGs. The Building 140 shaft below 10 feet would be abandoned due to the unsound condition of the building, health and safety hazards associated with field conditions, as well as many other unknowns. Institutional controls would be implemented to minimize inadvertent contact with radiologically-impacted media.

Alternative R-3: Survey, Decontamination, Disposal, Release, Close In-Place, and Institutional Controls

Alternative R-3 consists of decontamination of impacted buildings, dismantlement if necessary; survey of buildings, soils of former building sites, trenches resulting from sewer and storm line removal, and soils of remediated storm drains and sanitary sewers to meet the remedial action objectives; and surface scan of IR Sites 07 and 18 with removal of anomalies down to one foot, backfill with clean material to grade, installation of a semi-engineered two-foot soil cap above original grade, and use of institutional controls. The cap comprises an engineering control placed on top of a demarcation layer (durable fence mesh demarking the bottom of the two foot soil cap). Under this alternative the above-grade portions of Building 140, the discharge tunnel, and first 10 feet of the Building 140 shaft would be surveyed to verify that no residual radioactivity is present above the RGs. The shaft in Building 140 below 10 feet would not be remediated. The shaft below 10 feet and connecting piping would be closed in-place with backfilled stone and a concrete cap. Institutional controls would be utilized to prevent exposure to potentially unacceptable risk by the ROCs left in place.

5.2 DESCRIPTION OF SOIL REMEDIAL ALTERNATIVES

Soil at Parcel B presents a potential unacceptable risk to human health under anticipated future land-use scenarios. Section 5.2 of the TMSRA provides a description of the soil remedial alternatives. These alternatives included radiological support; however, they do not include the remedial activities targeting the ROCs in the radiologically-impacted sites.

5.3 DESCRIPTION OF GROUNDWATER REMEDIAL ALTERNATIVES

Section 5.3 of the TMSRA provides a description of the groundwater remedial alternatives. Groundwater monitoring for the ROCs would be used to confirm site conditions and ensure that, over time, the potential exposure pathway remains incomplete. The inclusion of radiological analyses is currently being evaluated as part of the base wide groundwater monitoring program.

5.4 DESCRIPTION OF RADIOLOGICALLY-IMPACTED SITES REMEDIAL ALTERNATIVES

Radiologically-impacted sites at Parcel B present a potential unacceptable risk to human health under anticipated future land-use scenarios. The remedial alternatives were developed for radiologically-impacted sites: 1) a no-action alternative; 2) a survey, decontamination, disposal, release, and institutional controls; and 3) a survey, decontamination, disposal, release, close in-place, and institutional controls. These alternatives are described in the following sections.

5.4.1 Alternative R-1: No Action

Under Alternative R-1, no remedial action would be taken. Radiologically-impacted sites would be left as is without implementing any institutional controls, containment, removal, or other mitigating actions. The no-action response is retained through the evaluation process as required by the NCP to provide a baseline for comparison with other alternatives.

5.4.2 Alternative R-2: Survey, Decontamination, Disposal, Release, and Institutional Controls

Under Alternative R-2 remedial actions would be taken to remove ROCS present at radiologically-impacted buildings above the RGs. These remedial actions may consist of decontamination of radiologically-impacted buildings and dismantlement of building structures if necessary. The buildings, except for Building 140, would be surveyed to verify that no residual radioactivity is present above the RGs.

The above-grade portions of Building 140, the discharge tunnel, and first 10 feet of the Building 140 Shaft would be surveyed to verify that no residual radioactivity is present above the RGs. The Building 140 Shaft below 10 feet would be abandoned as is due to the unsound condition of the building, health and safety hazards associated with field conditions, as well as many other unknowns. Institutional controls would be implemented to minimize inadvertent contact with radiologically-impacted media.

The soils of former building sites would be surveyed to verify that no residual radioactivity is present above the RGs. Limited soils excavation at former building sites may be preformed to remove radiologically-impacted soils.

The trenches resulting from sewer and storm line removal, and soils of remediated storm drains and sanitary sewers would be surveyed to verify that residual radioactivity is not present above the RGs. The radiologically-impacted storm drains and sanitary sewers would be removed under this alternative.

A surface scan would be performed at IR Sites 07 and 18. Limited soil excavations would be performed to remove radiological anomalies down to one foot. The excavated areas would be backfilled with clean material to grade. Subsequently, an engineering control comprising a two-

foot soil cap will be installed at and above original grade. A method of demarcation will be utilized to ensure proper identification of the bottom of the soil cap. The proposed soil cap will effectively reduce the dose and residual risk associated with ROCs at the release criteria at and below the original surface to the levels prescribed in the RAOs. Institutional controls would be utilized to prevent exposure to potentially unacceptable risk by the soil left in place and preserve the integrity of the soil cap.

5.4.3 Alternative R-3: Survey, Decontamination, Disposal, Release, Close In-Place, and Institutional Controls

Under Alternative R-3 remedial actions would be taken to remove ROCs present at radiologically-impacted buildings above the RGs with the exception of Building 140. These remedial actions may consist of decontamination of radiologically-impacted buildings and dismantlement of building structures if necessary. The building would be surveyed to verify that no residual radioactivity is present above the RGs.

Under this alternative the above-grade portions of Building 140, the discharge tunnel, and the first 10 feet of the Building 140 Shaft would be surveyed to verify that no residual radioactivity is present above the RGs. The shaft in Building 140 below 10 feet would not be remediated. The shaft below 10 feet and connecting piping would be closed in-place with backfilled stone and a concrete cap. Institutional controls would be utilized to prevent exposure to potentially unacceptable risk by the RGs left in place.

The soils of former building sites would be surveyed to verify that no residual radioactivity is present above the RGs. Limited excavation of the soils at former building sites may be performed to remove radiologically-impacted soils.

The trenches resulting from sewer and storm line removal, and soils of remediated storm drains and sanitary sewers would be surveyed to verify that residual radioactivity is not present above the RGs. Additional excavation may be required to remove radiologically-impacted soils based on survey results. The radiologically-impacted storm drains and sanitary sewers would be removed under this alternative.

A surface scan will be performed at IR Sites 07 and 18. Limited soil excavations would be performed to remove radiological anomalies down to one foot. The excavated areas would be backfilled with clean material to grade. Subsequently, an engineering control comprising a two-foot soil cap will be installed at and above original grade. A method of demarcation will be utilized to ensure proper identification of the bottom of the soil cap. The proposed soil cap will effectively reduce the dose and residual risk associated with ROCs at the release criteria at and below the original surface to the levels prescribed in the RAOs. Institutional controls would be utilized to prevent exposure to potentially unacceptable risk by the soil left in place and preserve the integrity of the soil cap.

6.0 DETAILED ANALYSIS OF ALTERNATIVES

This section provides a detailed analysis of each remedial alternative developed in Section 5.0. This information will be used to help select a final remedy for Parcel B. The alternatives are evaluated using criteria based on the statutory requirements of CERCLA as amended by the Superfund Amendments and Reauthorization Act, Section 121; the NCP; and *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA, 1988).

The NCP specifies nine criteria to be used in the comparative analysis. The first two are threshold criteria that must be satisfied for a remedy to be eligible for selection; the next five are balancing criteria used to evaluate the comparative advantages and disadvantages of the remedies; and the final two are modifying criteria generally taken into account after agency and public comments are received on the proposed plan. The nine criteria are listed below.

Overall protection of human health and the environment: This criterion describes how each alternative, as a whole, protects human health and the environment and indicates how each hazardous substance source is to be eliminated, reduced, or controlled.

Compliance with ARARs: This criterion evaluates each alternative's compliance with ARARs, or, if an ARAR waiver is required, how the waiver is justified. ARARs consider location-specific, chemical-specific, and cleanup action-specific concerns.

Long-term effectiveness and permanence: This criterion evaluates the effectiveness of each alternative in protecting human health and the environment after the remedial action is complete. Factors considered include magnitude of residual risks and adequacy and reliability of release controls.

Reduction of toxicity, mobility, or volume through treatment: This criterion evaluates the anticipated capability of each alternative's specific treatment technology to reduce the toxicity, mobility, or volume of hazardous substances.

Short-term effectiveness: This criterion addresses the effectiveness of each alternative in protecting human health and the environment during the construction and implementation phase. Factors considered include:

- Exposure of the community during implementation
- Exposure of the workers during construction
- Environmental impacts
- Time required to complete the remedial action and achieve RAOs

Implementability: This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of the required services and materials during its implementation. Factors considered include:

- Ability to construct the technology
- Reliability of the technology
- Monitoring considerations
- Availability of equipment and specialists

Cost: This criterion evaluates the capital and operation and maintenance (O&M) costs for each alternative. Capital and O&M cost estimates are order-of-magnitude level estimates and have an expected accuracy of minus 30 to plus 50 percent (EPA, 2000).

Community Acceptance: This criterion evaluates issues and concerns the public may have about each alternative. This criterion will be assessed after community comments have been received on the TMSRA, this addendum, and the proposed plan.

Regulatory Agency Acceptance: This criterion evaluates technical and administrative issues and concerns the regulatory agencies may have about each alternative. This criterion will be assessed after agency comments are received on the TMSRA, this addendum, and the proposed plan.

In the following sections each remedial alternative is evaluated to the two threshold and five balancing NCP criteria, and subsequently compared with other alternatives to assess the relative performance with respect to these criteria.

6.1 INDIVIDUAL ANALYSIS OF SOIL REMEDIAL ALTERNATIVES

A discussion of individual analysis of each of the soil alternatives with respect to the evaluation criteria is provided in the Section 6.1 of the TMSRA. Additional discussion of the soil remedial alternative is not provided in this addendum. Remedial alternatives that address radiologically-impacted soil sites in Parcel B are discussed in Section 6.5 below.

6.2 COMPARISON OF SOIL REMEDIAL ALTERNATIVES

A discussion comparing the five soil remedial alternatives is provided in Section 6.2 of the TMSRA. Additional discussion of the comparison of the soil remedial alternative is not provided in this addendum. Comparison of remedial alternatives that address radiologically-impacted soil sites in Parcel B is discussed in Section 6.6 below.

6.3 INDIVIDUAL ANALYSIS OF GROUNDWATER REMEDIAL ALTERNATIVES

A discussion of individual analysis of groundwater alternatives with respect to the evaluation criteria is provided in Section 6.3 of the TMSRA. Alternatives GW-2, GW-3A, and GW-3B include monitoring for radionuclides. The inclusion of monitoring for radionuclides does not change the conclusions presented in Section 6.3 of the TMSRA. Therefore, no additional discussion of the groundwater alternatives is presented in this addendum. The groundwater monitoring will provide additional data to make informed discussions pertaining to potential risk.

6.4 COMPARISON OF GROUNDWATER REMEDIAL ALTERNATIVES

A discussion comparing the groundwater alternatives is provided in the Section 6.4 of the TMSRA. Both alternatives include monitoring for radionuclides. The inclusion of monitoring for radionuclides does not change the conclusions presented in Section 6.4 of the TMSRA. Therefore, no additional discussion of the groundwater alternatives is presented in this addendum. The inclusion of radiological analyses is currently being evaluated as part of the base wide groundwater monitoring program.

6.5 INDIVIDUAL ANALYSIS OF RADIOLOGICALLY-IMPACTED SITES REMEDIAL ALTERNATIVES

A discussion of individual analyses of each of the radiologically-impacted sites remedial alternatives, with respect to the evaluation criteria described in Section 6.0, is described in the following sections. A summary is presented in Table 6-1.

6.5.1 Individual Analysis of Alternative R-1

Under Alternative R-1, no remedial action would be taken. Radiologically-impacted sites would be left as is without implementing any institutional controls, containment, removal, or other mitigating actions. The no-action response is retained through the evaluation process as required by the NCP to provide a baseline for comparison with other alternatives. As discussed below, the overall rating of Alternative R-1 is not acceptable.

6.5.1.1 Overall Protection of Human Health and the Environment: Alternative R-1

ROCs at Parcel B pose unacceptable risks to human health under the proposed planned reuse for several redevelopment blocks. Alternative R-1 does not address these risks; therefore, the rating for Alternative R-1 for overall protection of human health and the environment is not protective.

6.5.1.2 Compliance with ARARs: Alternative R-1

There is no need to identify ARARs for the no-action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action. CERCLA § 121 (42 United States Code [USC] § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by

the no-action alternative (EPA, 1988). Therefore, a discussion of compliance with ARARs is not appropriate for this alternative.

6.5.1.3 Long-term Effectiveness and Permanence: Alternative R-1

The factors evaluated under long-term effectiveness and permanence included the magnitude of residual risks and the adequacy and reliability of the controls. Under the no-action alternative, residual soils contamination above remediation goals have not been addressed. No controls to prevent exposure and no long-term management measures such as institutional controls are implemented. Based on this evaluation, the overall rating for Alternative R-1 for long-term effectiveness and permanence is not protective.

6.5.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment: Alternative R-1

Alternative R-1 does not include treatment that would result in the destruction, transformation, or irreversible reduction in contaminant mobility. Therefore, the overall rating for Alternative R-1 for the reduction of toxicity, mobility, and volume through treatment is poor.

6.5.1.5 Short-term Effectiveness: Alternative R-1

Four factors are considered as part of the short-term effectiveness criteria and are assessed below for Alternative R-1.

No remedial actions would occur therefore the on-site community would not be exposed to additional risks. The off-site community would be protected, as radiologically-impacted sites that present unacceptable risk would not be disturbed.

No workers would be exposed to health risks during implementation of Alternative R-1 because no remedial action will be taken.

No adverse environmental impacts would result from construction and implementation of Alternative R-1 because no remedial action will be taken.

Because no remedial action will be taken, no time would be required to complete Alternative R-1. However, time is an inappropriate measure because no action is taken.

The overall rating for Alternative R-1 for short-term effectiveness is very good based on no additional risks or exposure as compared with current conditions.

6.5.1.6 Implementability: Alternative R-1

Implementability includes technical and administrative feasibility and the availability of required resources. No action, including implementing institutional controls or constructing and operating a remedial system, would be required to implement this alternative; therefore,

Alternative R-1 would be very easily implemented, and the overall rating for Alternative R-1 for implementability is very good.

6.5.1.7 Cost: Alternative R-1

There are no costs associated with this alternative since no remedial activities would be performed. Therefore, the overall rating for Alternative R-1 for costs is excellent.

6.5.1.8 Overall Rating: Alternative R-1

Alternative R-1 is not acceptable because it fails to meet the threshold criteria and is not acceptable in terms of long-term effectiveness.

6.5.2 Individual Analysis of Alternative R-2

Alternative R-2 consists of decontamination of radiologically-impacted buildings and dismantlement if necessary. Surveys would be performed on buildings except Building 140, soils of former building sites, trenches resulting from sewer and storm line removal, and soils of remediated storm drains and sanitary sewers to meet the RAOs. A surface scan of IR Sites 07 and 18 would be performed with removal of anomalies down to one foot, backfill with clean material to grade, installation of a semi-engineered two-foot soil cap above original grade, and use of institutional controls. The proposed soil cover will effectively reduce the dose and residual risk associated with ROCs at the release criteria at and below the original surface to the levels described in the RAOs.

The above grade portions of Building 140, the discharge tunnel, and the first 10 feet of the Building 140 shaft would be surveyed to verify that no residual radioactivity is present above the RAOs. The Building 140 shaft below 10 feet would be abandoned as is due to the unsound condition of the building, health and safety hazards associated with field conditions, as well as many other unknowns. Institutional controls would be implemented to minimize inadvertent contact with radiologically-impacted media.

6.5.2.1 Overall Protection of Human Health and the Environment: Alternative R-2

Alternative R-2 provides protection to human health and the environment because it would remove radiologically-impacted surface soils at IR Sites 07 and 18, and remediate radiologically-impacted buildings (to include the above-grade portions of Building 140, the discharge tunnel, and the shaft to 10 feet below ground), storm drains, and sanitary sewers. Unacceptable risks based on planned reuse associated with radiologically-impacted soil remaining at IR Sites 07 and 18, and the portions of Building 140 shaft below 10 feet would be mitigated by implementing a combination of engineering and institutional controls. Therefore, the overall rating for Alternative R-2 for protection of human health and the environment is protective but limited based on available information.

6.5.2.2 Compliance with ARARs: Alternative R-2

Alternative R-2 includes both institutional controls and remedial actions. Both action- and chemical-specific ARARs associated with this alternative would be met. As a result, Alternative R-2 would meet ARARs.

6.5.2.3 Long-term Effectiveness and Permanence: Alternative R-2

The factors evaluated under long-term effectiveness and permanence included the magnitude of residual risks and the adequacy and reliability of the controls. Under Alternative R-2, radiologically-impacted soil in IR Sites 07 and 18 would be excavated and disposed of off site. Excavation would continue until results of confirmation samples indicate RAOs are met or until the excavation would extend to a depth of 1 foot below ground surface. Radiologically-impacted soils at IR Sites 07 and 18 at a depth greater than 1 foot below ground surface would be addressed by implementing a combination of engineering and institutional controls. The long-term effectiveness and permanence in areas where soil is excavated is rated excellent. The adequacy and reliability of this alternative is good for radiologically-impacted soils below 1 foot where institutional controls are used.

The long-term effectiveness and permanence of the existing Building 140 condition and shaft below 10 feet is unacceptable. Therefore, abandonment of the Building 140 shaft below 10 feet as is, due to the unsound condition of the building as well as many other hazards, results in long-term effectiveness and permanence that is not protective.

Under Alterative R-2, radiologically-impacted buildings, soils of former building sites, trenches resulting from sewer and storm line removal, and soils from excavation of storm drains and sanitary sewers will be remediated and surveyed to verify that the RAOs are met. The long-term effectiveness permanence is rated excellent. The overall rating for Alternative R-2 for long-term effectiveness and permanence is protective.

6.5.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment: Alternative R-2

Alterative R-2 includes excavation of radiologically-impacted soil and remediation of radiologically-impacted building materials. These remedial activities do not include treatment that would result in the destruction, transformation, or irreversible reduction in contamination mobility. Therefore, Alternative R-2 rating for reduction of toxicity, mobility, or volume is poor.

6.5.2.5 Short-term Effectiveness: Alternative R-2

Four factors are considered as part of the short-term effectiveness criteria and are assessed below for Alternative R-2.

The on-site and off-site community would be protected by containment controls such as dust suppression during scabbling, demolition, and removal of ROCs.

Workers would be protected during ROC remediation from Parcel B-impacted sites by implementing containment controls such as dust suppression and following health and safety protocols, including personal protective equipment and decontamination procedures.

The estimated time required to implement Alternative R-2 is less than 1 year, and the effects of implementing this alternative would be nearly immediate.

The overall rating for alternative R-2 for short-term effectiveness is very good.

6.5.2.6 Implementability: Alternative R-2

Implementability includes technical and administrative feasibility and the availability of required resources. The alternative is technically feasible and easily implemented since the action can be readily implemented using widely available commercial services, materials, and equipment. The overall rating for implementability is very good.

6.5.2.7 Cost: Alternative R-2

The cost estimate for Alternative R-2 was generated based on data collected from site information, dated drawings, and engineering estimates. The estimated cost for Alternative R-3 is rated as good.

Appendix B of this addendum provides a detailed description of the Alternative R-2 cost estimate and associated assumptions and limitations.

6.5.2.8 Overall Rating: Alternative R-2

Alternative R-2 is protective of human health and the environment, meets ARARs, is effective in the short and long term, is easily implemented, but is costly. The overall rating for this alternative is good.

6.5.3 Individual Analysis of Alternative R-3

Alternative R-3 consists of decontamination of impacted buildings, except for Building 140, dismantlement if necessary, and surveys to ensure the RAOs are met. This alternative assumes that the Building 140 shaft below 10 feet would be closed in-place with backfilled stone and a concrete cap and institutional controls will be assigned. Surface scans of IR Sites 07 and 18 with removal of anomalies down to one foot, backfill with clean material to grade, installation of a semi-engineered two-foot soil cap above original grade, and use of institutional controls. The proposed soil cover will effectively reduce the dose and residual risk associated with ROCs at the release criteria at and below the original surface to the levels described in the RAOs.

6.5.3.1 Overall Protection of Human Health and the Environment: Alternative R-3

Alternative R-3 provides protection to human health and the environment because it would remove radiologically-impacted surface soils at IR Sites 07 and 18, and remediate radiologically-impacted buildings, storm drains, and sanitary sewers. Unacceptable risks based on planned reuse associated with radiologically-impacted soil remaining at IR Sites 07 and 18 would be mitigated by implementing a combination of engineering and institutional controls. The Building 140 shaft below 10 feet and associated piping would be closed in-place with backfilled stone, covered with a concrete cap, and institutional controls implemented. The backfilled stone and concrete cap would provide a barrier to eliminate risk associated with potentially encountering ROCs. Therefore, the overall rating for Alternative R-3 for protection of human health and the environment is protective.

6.5.3.2 Compliance with ARARs: Alternative R-3

Alternative R-3 includes both institutional controls and remedial actions. Both action- and chemical-specific ARARs associated with this alternative would be met. As a result, Alternative R-3 would meet ARARs.

6.5.3.3 Long-term Effectiveness and Permanence: Alternative R-3

The factors evaluated under long-term effectiveness and permanence included the magnitude of residual risks and the adequacy and reliability of the controls. Under Alternative R-3, radiologically-impacted soil from the surface of IR Sites 07 and 18 would be excavated and disposed of off site. Excavation would continue until results of confirmation samples indicate RAOs are met or until the excavation would extend to a depth of 1 foot below ground surface. Radiologically-impacted soils at IR Sites 07 and 18 at a depth greater than 1 foot below ground surface would be addressed by implementing a combination of engineering and institutional controls. The long-term effectiveness and permanence in areas where soil is excavated is rated excellent. The adequacy and reliability of this alternative is good for radiologically-impacted soils below 1 foot where institutional controls are used.

The long-term effectiveness and permanence of the existing Building 140 condition and shaft below 10 feet is unacceptable. Thus, closure in-place of the Building 140 shaft below 10 feet with backfilled stone and a concrete, provides long-term effectiveness and permanence.

Under Alterative R-3, radiologically-impacted buildings, soils of former building sites, trenches resulting from sewer and storm line removal, and soils of excavated storm drains and sanitary sewers will be remediated and surveyed to verify that the RAOs are met. The long-term effectiveness permanence is rated excellent. The overall rating for Alternative R-3 for long-term effectiveness and permanence is very good.

6.5.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment: Alternative R-3

Alterative R-3 includes excavation of radiologically-impacted soil and remediation of radiologically-impacted building materials. These remedial activities do not include treatment that would result in the destruction, transformation, or irreversible reduction in contamination mobility. Therefore, Alternative R-3 rating for reduction of toxicity, mobility, or volume is poor.

6.5.3.5 Short-term Effectiveness: Alternative R-3

Four factors are considered as part of the short-term effectiveness criteria and are assessed below for Alternative R-3.

The on-site and off-site community would be protected by containment controls such as dust suppression during scabbling, demolition, and removal of ROCs.

Workers would be protected during ROC remediation from Parcel B-impacted structures by implementing containment controls such as dust suppression and following health and safety protocols, including personal protective equipment and decontamination procedures.

The estimated time required to implement Alternative R-3 is less than 1 year, and the effects of implementing this alternative would be nearly immediate.

The overall rating for alternative R-3 for short-term effectiveness is very good.

6.5.3.6 Implementability: Alternative R-3

Implementability includes technical and administrative feasibility and the availability of required resources. The alternative is technically feasible and easily implemented since the action can be readily implemented using widely available commercial services, materials, and equipment. The overall rating for implementability is very good.

6.5.3.7 Cost: Alternative R-3

The cost estimate for Alternative R-3 was generated based on data collected from site information, dated drawings, and engineering estimates. The estimated cost for Alternative R-3 is rated as good.

Appendix B of this addendum provides a detailed description of the Alternative R-3 cost estimate and associated assumptions and limitations.

6.5.3.8 Overall Rating: Alternative R-3

Alternative R-3 is protective of human health and the environment, meets ARARs, is effective in the short and long term, is easily implemented, but is costly. The overall rating for this alternative is very good.

6.6 COMPARISON OF RADIOLOGICALLY-IMPACTED SITE REMEDIAL ALTERNATIVES

This section compares the three radiologically-impacted sites remedial alternatives. The discussion of each evaluation criterion generally proceeds from the alternative that best satisfies the criterion to the one that least satisfies the criterion. Table 6-1 summarizes the ratings for each alternative and shows a comparison of the ratings for each alternative for the two threshold and five balancing NCP evaluation criteria.

6.6.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is a threshold criterion. Protection is not measured by degree; rather, each alternative is considered as either protective or not protective. Alternative R-3 is protective. The Alternative is protective because it includes remediation that reduces exposure to ROCs. Alternative R-2 is protective except for the Building 140 shaft below 10 feet and associated piping. Alternative R-1 does not address any risk at the site and hence does not provide any protection to human health and the environment.

6.6.2 Compliance with Applicable or Relevant and Appropriate Requirements

Compliance with ARARs is a threshold evaluation criterion. An alternative must either comply with ARARs or justification must be provided for a waiver. Alternatives R-2 and R-3 fulfill all the pertinent ARARs. Alternative R-1 does not meet the ARARs.

6.6.3 Long-term Effectiveness and Performance

Alternative R-3 provides very good long-term effectiveness and performance. Alternative R-2 provides long-term effectiveness and performance for radiologically-impacted sites except for the Building 140 shaft below 10 feet and associated piping. Alternative R-1 will have very little long-term effectiveness and performance because it includes no action.

6.6.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives R-1, R-2, and R-3 rate equally poorly because they do not include treatment that would result in the destruction, transformation, or irreversible reduction in ROC mobility.

6.6.5 Short-term Effectiveness

Alternative R-1 has the least effect on the community, remedial workers, or the environment because it includes no actions and therefore would not disturb the ROCs. Alternatives R-2 and R-3 include removing and hauling contaminated soil. This would pose potential risk to the community, remedial workers, or the environment, although this risk is considered low and mitigation measures would be implemented.

6.6.6 Implementability

Distinction among the alternatives for implementability is minimal. Alternatives R-2 and R-3 require implementation of institutional controls and utilize standard technologies that are easy to implement. Alternative R-1 does not involve remedial technologies or institutional controls and requires no implementation.

6.6.7 Cost

Alternative R-1 requires no action; therefore, no costs are associated with this alternative. Alterative R-2 is the least costly because it does not address the Building 140 shaft below 10 feet and associated piping. Alternative R-3 is the most costly but does address all radiologically-impacted sites.

6.6.8 Overall Rating of Impacted Building Alternatives

An overall rating was assigned to each alternative. Alterative R-3 is rated very good overall for the two threshold and five balancing NCP evaluation criteria. Alternative R-2 is rated good for the two threshold and five balancing NCP evaluation criteria. Alternative R-1 is rated as not acceptable.

6.7 CONCLUSION

Section 6.5 of the TMSRA summarizes the rationale for re-evaluating the current remedy based on the updated information about the site and subsequent revisions to the conceptual site model.

Radiological contamination was not addressed by the record of decision; however, radiological contamination is present at Parcel B. This radiological addendum to the TMSRA was prepared to evaluate remediation alternatives for radiological contamination.

The final soil remedy for Parcel B will be a combination of alternatives presented in the TMSRA and the alternative presented in this addendum for soil. The groundwater remedy will be an alternative present in the TMSRA with the addition of groundwater monitoring for ROCs. The remedy for radiologically-impacted structures in Parcel B is addressed by the alternatives presented in this addendum.

7.0 REFERENCES

Atomic Energy Commission (AEC). 1974. *Regulatory Guide 1.86.* Termination of Operating Licenses for Nuclear Reactors. June 1974.

Brown and Caldwell. 1995. *Final Draft Report for Air Monitoring Project, Hunters Point Annex,* Phase II. January.

Department of Defense [DoD]. 2000. *Multi-Agency Radiological Site Survey Investigation Manual (MARSSIM) (NUREG-1575).*

Department of Navy (DON). 1997. *Hunters Point Shipyard, Parcel B Final Record of Decision.* Hunters Point Shipyard, San Francisco, California. October 7.

_____. 2006. *Revised Final Basewide Radiological Removal Action, Action Memorandum.* Hunters Point Shipyard, San Francisco, California. February 14.

Department of Navy and DTSC. 2000. "Memorandum of Agreement Between the United States Department of the Navy and the California Department of Toxic Substances Control."

Naval Sea Systems Command (NAVSEA). 2004. *Hunters Point Shipyard Final Historical Radiological Assessment.* Volume II.

San Francisco Redevelopment Agency (SFRA). 1997. *Hunters Point Shipyard Redevelopment Plan.* July 14.

San Francisco Regional Water Quality Control Board. 2003. Letter Regarding Concurrence that A-aquifer Groundwater at the Hunters Point Naval Shipyard, San Francisco, Meets the Exemption Criteria in the SWRCB Source of Drinking Water Resolution 88-63. From Mr. Curtis Scott, Water Board. To Mr. Keith Forman, Base Realignment and Closure Environmental Coordinator, Naval Facilities Engineering Command. September 25.

SulTech. 2007. Parcel B *Technical Memorandum in Support of a Record of Decision Amendment.* San Diego: SulTech. December 19.

Tetra Tech EC, Inc. 2003. *Final First Five-Year Review of Remedial Actions Implemented at Hunters Point Shipyard.* San Francisco, California. December 10.

_____. 2006. *Base-wide Storm Drain and Sanitary Sewer Removal Draft Project Work Plan.* Hunters Point Shipyard, San Francisco, California. February 14.

U.S. Environmental Protection Agency (EPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA; Interim Final.* U.S. Environmental Protection Agency Guidance. EPA 540-G-89-004. October.

_____. 1989. Chapter 10, Risk Assessment Guidance for Superfund Vol. 1 Human Health Evaluation Manual, EPA/540/1-89/002, December.

_____. 1996. *Technology Screening Guide for Radioactively Contaminated Sites.* Washington, D.C.: Office of Air and Radiation; Office of Solid Waste and Emergency Response. EPA 402-R-96-017. November.

_____. 1997. *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, Attachment A, USEPA, OSWER Directive 9200.4-18. August 22.

_____. 2000. A Guide to Developing and Documenting Cost Estimates during the Feasibility Study. EPA/540/R-00/002. Washington, D.C. July.

TABLES

TABLE 2-1

PARCEL B IMPACTED AREAS, RADIONUCLIDES OF INTEREST, HISTORICAL USES, AND PLANNED REUSE

Building Number or Area Title	Isotopes of Interest	Building or Area Use	Redevelopment Block Planned Reuse
103	strontium-90, cesium-137, plutonium-239	Barracks, decontamination center, and now artist studios	Mixed use
113	strontium-90, cesium-137, plutonium-239	Tugboat maintenance, torpedo storage and overhaul, sample storage from Bikini Atoll, currently used for San Francisco Police storage	Mixed use
113A	cesium-137, radium-226	Torpedo storage, NDT, waste storage, and currently leased by Smith Emery	Mixed use
130	cesium-137, radium-226	Shops, radium devices, and LLRW storage, now used for environmental HazMat storage	Mixed use
140 Pumphouse and discharge channel	strontium-90, cesium-137, radium-226, plutonium-239	Used to pump water from drydocks	Educational/Cultural/ Open Space
142 Site	strontium-90, cesium-137, radium-226, plutonium-239	Air raid shelter, high-level sample storage, and low-level sample counting	Educational/Cultural
146	strontium-90, cesium-137, radium-226	Industrial and photo lab, radioactive waste storage, and radium device turn-in	Research and development
157 Site	cobalt-60, cesium-137, radium-226	Shipyard laboratory, NDT, radiography, and industrial shop	Mixed use
IR-07 and IR-18	strontium-90, cesium-137, radium-226, plutonium-239	Potential burial of contaminated ship decontamination debris and burial of radioluminescent devices	Research and development and open space
Sanitary Sewers	strontium-90, cesium-137, radium-226	Radiological waste from buildings	Educational/cultural, research and development, and mixed use

TABLE 2-1

PARCEL B IMPACTED AREAS, RADIONUCLIDES OF INTEREST, HISTORICAL USES, AND PLANNED REUSE

Building Number or Area Title	Isotopes of Interest	Building or Area Use	Redevelopment Block Planned Reuse
Storm Drains	strontium-90, cesium-137, radium-226	Radiological waste from buildings	Educational/cultural, research and development, and mixed use

Notes:

HazMat – hazardous materials
IR – Installation Restoration
LLRW – low-level radioactive waste
NDT – non-destructive testing

TABLE 2-2

LIST OF RADIONUCLIDES, HALF-LIVES, AND RADIATIONS EMITTED

Radionuclide	Half-life	Radiations Released When Decayed
cesium-137	30 years	Beta particle, gamma ray
cobalt-60	5.3 years	Beta particle, gamma rays
plutonium-239	24,100 years	Alpha particle, x-rays
radium-226	1,600 years	Alpha and Beta particles, and gamma rays
strontium-90	29.1 years	Beta particles

TABLE 2-3

PARCEL B BUILDING/AREA ASSESSMENT AND CLASSIFICATION

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways						
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System
103				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	N
113				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N
113A				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N
130				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N
140 and Discharge Channel				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	L
142				✓		L	N	N	N	N	L	N	L	N	N	N	N	L	N
146			✓			N	N	N	N	N	L	N	N	N	N	N	N	L	N
157 Site				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N
IR-07				✓		L	L	N	N	N	L	N	L	L	N	N	N	N	N
IR-18				✓		L	L	N	N	N	L	N	L	L	N	N	N	N	N
Storm Drains		✓				N	L	N	N	N	L	H	N	L	N	N	N	L	M
Sanitary Sewers		✓				N	L	N	N	N	L	H	N	L	N	N	N	L	M

Notes:

H High – Evidence of contamination in the media or migration pathway has been identified.
IR Installation Restoration
L Low – The potential for contamination in the type of media or migration pathway is remote.
M Moderate – The potential for contamination in the media or migration pathway exists, although the extent has not been fully assessed.
N None – Evidence of contamination in the specific media or migration pathway has not been found, or known contamination has been removed, and surveys indicate that the media or migration pathway meets today's remedial action objectives.

TABLE 3-1

PARCEL B BUILDINGS, FORMER BUILDING SITES, AND FILL AREAS ALONG WITH THEIR REDEVELOPMENT BLOCKS, PLANNED REUSE, AND EXPOSURE SCENARIO

Building/ Site Number	Redevelopment Block	Redevelopment Block Planned Reuse	Reuse Scenario
103	4	Mixed Use	Residential
113	7	Mixed Use	Residential
113A	7	Mixed Use	Residential
130	9, 12	Mixed Use	Residential
140 and discharge channel	16, BOS-3	Educational/Cultural and Open Space	Industrial and Recreational
142	16	Educational/Cultural	Industrial
146	6	Research and Development	Residential
157 Site	15	Mixed Use	Residential
IR-07	2, 3, BOS-1	Research and Development, Open Space	Residential and Recreational
IR-18	1, 2, BOS-1	Mixed Use, Research and Development, Open Space	Residential and Recreational

Notes:

IR – Installation Restoration
BOS – Parcel B Open Space

TABLE 3-2

HUNTERS POINT SHIPYARD REMEDIATION GOALS

Radionuclide	Surfaces[g] (dpm/100 cm^2)		Soil[c g] (pCi/g)		Water[e g] (pCi./L)
	Equipment, Waste[a]	Structures[b]	Construction Worker	Residential	Equipment, Waste[a]
cesium-137	5,000	5,000	0.113	0.113	119
cobalt-60	5,000	5,000	0.0602	0.0361	100
plutonium-239	100	100	14.0	2.59	15
radium-226	100	100	1.0[d]	1.0[d]	5.0[f]
strontium-90	1,000	1,000	10.8	0.331	8.0

Notes:

[a] These objectives are based on AEC *Regulatory Guide 1.86* (1974). Objectives for removable surface activity are 20 percent of these values.

[b] These objectives are based on 25 mrem/y.

[c] EPA PRGs for two future-use scenarios.

[d] Objective is 1 pCi/g above background per agreement with EPA.

[e] Release criteria for water have been derived from *Radionuclides Notice of Data Availability Technical Document,* (EPA, 2000) by comparing the limits from two criteria and using the most conservative limit.

[f] Limit is for total radium concentration.

[g] Taken from *Revised Final Basewide Radiological Removal Action, Action Memorandum.* Hunters Point Shipyard, San Francisco, California. February 14, 2006.

AEC – Atomic Energy Commission
cm^2 – square centimeter
dpm – disintegration per minute
EPA – U.S. Environmental Protection Agency
mrem/y – millirem per year
pCi/g – picocurie per gram
pCi/L – picocurie per liter
PRG – Preliminary Remediation Goal

TABLE 3-3

RESRAD-BUILD RESULTS[a]

Parcel B Impacted Sites	Radiological Risk[b]	Dose[c]
Building 103	1.48×10^{-6}	7.02
Building 113	1.48×10^{-6}	7.02
Building 113A	1.60×10^{-6}	1.45
Building 130	1.60×10^{-6}	1.45
Building 140	1.44×10^{-6}	5.43
Building 146	1.16×10^{-6}	1.20

Notes:

[a] Total risk and dose is equivalent to incremental risk and dose. Actual calculated dose and risk will be based on field measurements from the final status survey results.
[b] Total excess lifetime carcinogen risk
[c] millirems per year

TABLE 3-4

RESRAD RESULTS

Total Dose and Risk[a]		
Impacted Soil Areas	**Radiological Risk[b]**	**Dose[c]**
Building 142 Site	6.39×10^{-5}	3.48
Building 157 Site	8.90×10^{-5}	4.86
IR-07	4.51×10^{-5}	3.27
IR-18	4.51×10^{-5}	3.27
Incremental Dose and Risk		
Impacted Soil Areas	**Radiological Risk[a]**	**Dose[b]**
Building 142 Site	4.35×10^{-5}	2.39
Building 157 Site	5.97×10^{-5}	3.25
IR-07	3.02×10^{-5}	2.26
IR-18	3.02×10^{-5}	2.26

Notes:

[a] Actual calculated dose and risk will be based on field measurements from the final status survey results

[b] Total excess lifetime carcinogen risk

[c] millirems per year

IR – Installation Restoration

TABLE 3-5

COMBINED TOTAL RISK FROM CHEMICAL AND RADIOLOGICAL RISKS

Parcel B Impacted Sites	Radiological Risk	Chemical Risk[a]	Redevelopment Block	TMSRA Grid(s)	Risk Combination Results
Building 103	1.48×10^{-6}	Not Evaluated	4	Not Evaluated	1.48×10^{-6}
Building 113	1.48×10^{-6}	2.00×10^{-4}	7	B3228, B3229	2.01×10^{-4}
Building 113A	1.60×10^{-6}	2.00×10^{-4}	7	B3228	2.01×10^{-4}
Building 130	1.60×10^{-6}	3.00×10^{-4}	9	B3718	3.01×10^{-4}
Building 140	1.44×10^{-6}	1.00×10^{-4}	16	AX04	1.01×10^{-4}
Building 142 Site	6.39×10^{-5}	1.00×10^{-4}	16	AX04	1.64×10^{-4}
Building 146	1.16×10^{-6}	1.00×10^{-4}	6	B1523, B1623	1.01×10^{-4}
Building 157 Site	8.90×10^{-5}	2.00×10^{-4}	15	B4716	2.89×10^{-4}
IR-07	4.51×10^{-5}	2.00×10^{-4}	2	B0336, B0434, B0636, B1231	2.45×10^{-4}
IR-18	4.51×10^{-5}	1.00×10^{-4}	2	B0339	1.45×10^{-4}

Notes:

[a] Chemical risk was taken from TMSRA Tables A-15 and A-16.

IR – Installation Restoration
TMSRA – Technical Memorandum in Support of a Record of Decision Amendment.

TABLE 3-6

COMBINED INCREMENTAL RISK FROM CHEMICAL AND RADIOLOGICAL RISKS

Parcel B Impacted Sites	Radiological Risk	Chemical Risk[a]	Redevelopment Block	TMSRA Grid(s)	Risk Combination Results
Building 103	1.48×10^{-6}	Not Evaluated	4	Not Evaluated	1.48×10^{-6}
Building 113	1.48×10^{-6}	7.00×10^{-9}	7	B3228	1.48×10^{-6}
Building 113A	1.60×10^{-6}	7.00×10^{-9}	7	B3228	1.60×10^{-6}
Building 130	1.60×10^{-6}	8.00×10^{-6}	12	B3915	9.60×10^{-6}
Building 140	1.44×10^{-6}	1.00×10^{-4}	16	AX04	1.01×10^{-4}
Building 142 Site	4.35×10^{-5}	1.00×10^{-4}	16	AX04	1.44×10^{-4}
Building 146	1.16×10^{-6}	7.00×10^{-6}	6	B1626	8.16×10^{-6}
Building 157 Site	5.97×10^{-5}	4.00×10^{-5}	15	B4716	9.97×10^{-5}
IR-07	3.02×10^{-5}	3.00×10^{-3}	3	B1330	3.03×10^{-3}
IR-18	3.02×10^{-5}	9.00×10^{-6}	2	B0142, B0242	3.92×10^{-5}

Notes:

[a] Chemical risk was taken from TMSRA Tables A-19 and A-20.

IR – Installation Restoration
TMSRA – Technical Memorandum in Support of a Record of Decision Amendment.

TABLE 4-1

POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs TO BE CONSIDERED FOR POTENTIALLY CONTAMINATED SITES AT HPS

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
Safe Drinking Water Act (42 USC, ch. 6A, § 300[f]-300[j] – 26) [b]				
Maximum contaminant levels (MCLs) for radionuclides (b) Combined ^{226}radium and ^{228}radium – 5 pCi/L (c) Gross Alpha (including ^{226}radium but excluding radon and uranium) – 15 pCi/L (d) Beta and Photon – 4 mrem/y - Table A Tritium – 20,000 pCi/L ^{90}Strontium – 8 p/Ci/L (e) Uranium – 30 μg/L	Drinking Water	40 CFR §141.66	Not an ARAR	Not applicable or relevant and appropriate because the response action is not at the tap of a drinking water source and the media of concern. Aquifer-B may be used as drinking water.
Defines RCRA-hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste	22 CCR, Sections 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether waste is hazardous but already identified in the TMSRA (SulTech, 2007).
Defines "non-RCRA hazardous waste"	Waste	CCR tit. 22 § 66261.22(a)(3) and (4), § 66261.24(a)(2)-(a)(8), § 66261.101, § 66261.3(a)(2)(C), and § 66261.3(a)(2)(F)	Applicable	Applicable for determining whether a waste is or is not RCRA hazardous waste but already identified in the TMSRA (SulTech, 2007).
Definitions of designated waste, nonhazardous waste, and inert waste.		CCR tit. 27 §§ 20210, 20220, and 20230	Applicable	Potential ARARs for classifying waste and determining ARAR status of other requirements but already identified in the TMSRA (SulTech, 2007).

TABLE 4-1

POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs TO BE CONSIDERED FOR POTENTIALLY CONTAMINATED SITES AT HPS

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
Uranium Mill Tailings Radiation Control Act (42 USC, Chapter 88, Sections 192.02, 192.12(a,b), 192.42)[a]				
Standards for cleanup of land and buildings contaminated with ^{226}radium, ^{228}radium, and thorium from inactive uranium processing sites. As a result of residual radioactive materials from any designated processing site: (a) The concentration of ^{226}radium in land averaged over any area of 100 square meters shall not exceed the background level by more than: (1) 5 pCi/g, averaged over the first 15 cm of soil below the surface, and (2) 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface.	UMTRCA sites	40 CFR, Parts 192.12(a), 192.32(b)(2) and 192.41	Relevant and Appropriate	Not applicable because Parcel B is not an UMTRCA site but is potentially relevant and appropriate for sites with soil contaminated with radioactive waste. The surface concentration of 5pCi/g is potentially relevant and appropriate only for an unrestricted land use scenario. The subsurface contamination at the site does not match the distribution expected at a regulated Title I site (i.e., discrete deposits of high activity (typically 300 pCi/g – 1,000 pCi/g). Therefore, the subsurface concentration is not a potential ARAR.
In any occupied or habitable building, the objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL. In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL. Provisions applicable to ^{222}radon shall also apply to ^{220}radon.	UMTRCA sites	40 CFR § 192.12(b)(1) §192.41(b)	Relevant and Appropriate	Not applicable because Parcel B is not an UMTRCA site. Potentially relevant and appropriate since the alternatives will result in radioactive material with radioactive contamination that may produce this level of dose.
Concentration limits for cleanup of gamma radiation in buildings at inactive uranium processing sites designated for remedial action. In any occupied or habitable building, the level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour.	UMTRCA sites	40 CFR §192.12(b)(2)	Relevant and Appropriate	Not applicable because Parcel B is not an UMTRCA site. A potential relevant and appropriate ARAR since the alternatives will leave a building with radioactive contamination at the remedial action objective level.

TABLE 4-1

POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs TO BE CONSIDERED FOR POTENTIALLY CONTAMINATED SITES AT HPS

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
Radiological Criteria for License Termination				
A site will be considered acceptable for unrestricted use if the residual radioactivity distinguishable from background radiation results in TEDE to an average member of the critical group that does not exceed 25 mrem/y, including that from groundwater sources of drinking water, and that the residual radioactivity has been reduced to ALARA.	Existing NRC-licensed radiologically contaminated site	10 CFR, Part 20.1402	Relevant and appropriate	This ARAR is potentially relevant and appropriate for an unrestricted land-use scenario.
A site will be considered acceptable for license termination under restricted conditions if: (a) The licensee can demonstrate that further reductions in residual radioactivity necessary to comply with the provisions of § 20.1402 would result in net public or environmental harm or were not being made because the residual levels associated with restricted conditions are ALARA. Determination of the levels which are ALARA must take into account consideration of any detriments, such as traffic accidents, expected to potentially result from decontamination and waste disposal; (b) The licensee has made provisions for legally enforceable institutional controls that provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem (0.25 mSv) per year; (c) The licensee has provided sufficient financial assurance to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site. Acceptable financial assurance mechanisms are--	Existing NRC-licensed radiologically contaminated site	10 CFR §20.1403(a),(b),(c),(d),(e)	Not an ARAR	The PRGs and remedial actions for Parcel B are protective of human health and the environment and are more stringent and protective than the criteria in 10 CFR § 20.1403. Therefore, these regulations will not be carried forward in the CERCLA process as potential Federal ARARs.

TABLE 4-1

POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs TO BE CONSIDERED FOR POTENTIALLY CONTAMINATED SITES AT HPS

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
(1) Funds placed into an account segregated from the licensee's assets and outside the licensee's administrative control as described in § 30.35(f)(1) of this chapter; (2) Surety method, insurance, or other guarantee method as described in § 30.35(f)(2) of this chapter; (3) A statement of intent in the case of Federal, State, or local Government licensees, as described in § 30.35(f)(4) of this chapter; or (4) When a governmental entity is assuming custody and ownership of a site, an arrangement that is deemed acceptable by such governmental entity. (d) The licensee has submitted a decommissioning plan or License Termination Plan (LTP) to the Commission indicating the licensee's intent to decommission in accordance with §§ 30.36(d), 40.42(d), 50.82 (a) and (b), 70.38(d), or 72.54 of this chapter, and specifying that the licensee intends to decommission by restricting use of the site. The licensee shall document in the LTP or decommissioning plan how the advice of individuals and institutions in the community who may be affected by the decommissioning has been sought and incorporated, as appropriate, following analysis of that advice. (1) Licensees proposing to decommission by restricting use of the site shall seek advice from such affected parties regarding the following matters concerning the proposed decommissioning-- (i) Whether provisions for institutional controls proposed by the licensee; (A) Will provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem (0.25 mSv) TEDE per year; (B) Will be enforceable; and				

TABLE 4-1

POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs TO BE CONSIDERED FOR POTENTIALLY CONTAMINATED SITES AT HPS

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
(C) Will not impose undue burdens on the local community or other affected parties. (ii) Whether the licensee has provided sufficient financial assurance to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site; (2) In seeking advice on the issues identified in § 20.1403(d)(1), the licensee shall provide for: (i) Participation by representatives of a broad cross section of community interests who may be affected by the decommissioning; (ii) An opportunity for a comprehensive, collective discussion on the issues by the participants represented; and (iii) A publicly available summary of the results of all such discussions, including a description of the individual viewpoints of the participants on the issues and the extent of agreement and disagreement among the participants on the issues; and (e) Residual radioactivity at the site has been reduced so that if the institutional controls were no longer in effect, there is reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group is as low as reasonably achievable and would not exceed either-- (1) 100 mrem (1 mSv) per year; or (2) 500 mrem (5 mSv) per year provided the licensee-- (i) Demonstrates that further reductions in residual radioactivity necessary to comply with the 100 mrem/y (1 mSv/y) value of paragraph (e)(1) of this section are not technically achievable, would be prohibitively expensive, or would result in net public or				

TABLE 4-1

POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs TO BE CONSIDERED FOR POTENTIALLY CONTAMINATED SITES AT HPS

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
environmental harm; (ii) Makes provisions for durable institutional controls; (iii) Provides sufficient financial assurance to enable a responsible government entity or independent third party, including a governmental custodian of a site, both to carry out periodic rechecks of the site no less frequently than every 5 years to assure that the institutional controls remain in place as necessary to meet the criteria of § 20.1403(b) and to assume and carry out responsibilities for any necessary control and maintenance of those controls. Acceptable financial assurance mechanisms are those in paragraph (c) of this section.				
Performance objectives for the land disposal of LLRW. Concentrations of radioactive material that may be released into the general environment must not result in an annual dose exceeding 25 mrem to the body or any organ of a member of the general public.	Existing NRC-licensed LLRW disposal site	10 CFR, Part 61.41	Relevant and appropriate	This ARAR is potentially relevant and appropriate for a restricted land-use scenario.
NESHAPs under CAA that Apply to Radionuclides				
Emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/y.	Facility owned or operated by the Department of Energy that emits any radionuclide other than radon-222 and radon-220 into the air	40 CFR, Part 61, Subpart H, § 61.92	Relevant and appropriate	Not applicable because Parcel B is not a Department of Energy site but may be relevant and appropriate if there is the potential for airborne emissions radionuclides other than radon. Only an ARAR until cleanup action is completed. Not an ARAR for residual contamination after cleanup.
Emissions of radionuclides, including iodine, to the ambient air from a facility regulated under this subpart shall not exceed those amounts that would cause any member of the public to receive in any year an effective	Facilities owned or operated by any federal agency other than the Department	40 CFR, Part 61 Subpart I, § 61.102	Applicable	The requirements are applicable since fugitive dust may be generated during implementation of remedial action at Parcel B. The exposure to the public due to remedial action operations at

TABLE 4-1

POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs TO BE CONSIDERED FOR POTENTIALLY CONTAMINATED SITES AT HPS

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
dose equivalent of 10 mrem/y. Emissions of iodine to the ambient air from a facility regulated under this subpart shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 3 mrem/y.	of Energy and not licensed by the NRC			Parcel B is not likely to exceed 10 mrem/y because of the following reasons: (1) The concentrations of any radionuclide in dust are relatively low as previously measured in air samples, and (2) The concentration of any radionuclide in dust will be reduced by use of engineering controls such as wetting of soils.

TABLE 4-1

POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs TO BE CONSIDERED FOR POTENTIALLY CONTAMINATED SITES AT HPS

Notes:

[a] Only the substantive provisions of the requirements cited in this table are potential ARARs.

µg/L – microgram per liter
§ – section
ALARA – as low as reasonable achievable
ARAR – applicable or relevant and appropriate requirements
CAA – Clean Air Act
CCR – California Code of Regulations
CFR – Code of Federal Regulations
ch. – chapter
cm – centimeter
HPS – Hunters Point Shipyard
IC – institutional control
LLRW – low-level radioactive waste
MCL – maximum contaminant level
mrem/y – millirem per year
NESHAP – National Emissions Standards for Hazardous Air Pollutants
NRC – Nuclear Regulatory Commission
pCi/g – picocurie per gram
pCi/L – picocurie per liter
RCRA – Resource Conservation and Recovery Act
TCLP – Toxicity Characteristic Leaching Procedure
TEDE – total effective dose equivalent
Tit. – title
TMSRA – Technical Memorandum in Support of a Record of Decision Amendment
UMTRCA – Uranium Mill Tailings Radiation Control Act
USC – United States Code
WL – Working Level

TABLE 4-2

IDENTIFICATION AND SCREENING OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology Type	Remedial Technology Process Option	Technology Process Option Description	Screening Comments
No Action	Not Applicable	Not Applicable	No action	**Retained** as a stand-alone alternative as required by NCP
Institutional Controls	Institutional Controls	Institutional Controls	Allows fencing, barriers, and posting signs to restrict land use where there is exposure to potentially contaminated soil. Prohibits activities not specified for the designated land use; prohibits growing produce in native soil. Restricts the use of the parcel to those re-uses identified at the time the ROD amendment is signed; includes criteria during and after future development to assure that mitigated exposure conditions are maintained such as covers, barriers, or other engineering controls.	**Retained** – easily implemented and effective; usually required to restrict activity based on land use
Removal	Excavation	Conventional Excavation	Excavation of contaminates, soil, and materials with the ROC concentrations above cleanup goals.	**Retained** – effective for ROCs and quickly implemented; moderate cost
		Methane Source Removal	Methane Source Removal	**Eliminated** – Not effective for ROCs and retained by SulTech, 2007
		Off-Site Disposal	Disposal of excavated radioactively contaminated soil and material into a facility licensed to receive low-level radioactive waste.	**Retained** – effective; easily and quickly implemented; permanent remedy; moderate cost

TABLE 4-2

IDENTIFICATION AND SCREENING OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology Type	Remedial Technology Process Option	Technology Process Option Description	Screening Comments
Treatment	Biological Treatment	Bioremediation	Reduces contaminants from soil by metabolizing organic compounds with biological amendments.	**Eliminated** – not effective for ROCs; eliminated in SulTech, 2007
	Physical/ Chemical Treatment	Soil Washing	Remove contaminants by exposing soil to an aqueous washing solution in a reactor.	**Eliminated** – eliminated in SulTech, 2007
		Solidification/ Stabilization	Reduction of contaminant mobility through physical or chemical reaction with stabilizing agents.	**Eliminated** – eliminated in SulTech, 2007
		Chemical Oxidation	Conversion of inorganic contaminants to nonhazardous compounds using an oxidizing agent.	**Eliminated** – eliminated in SulTech, 2007
		Solvated Electron Process	Soil is treated by first mixing with liquid ammonia to form a soil/ammonia slurry, adding elemental calcium or sodium to the slurry; separating the ammonia from the soil as a liquid until most of the ammonia is removed and then as a vapor by warming the soil.	**Eliminated** – eliminated in SulTech, 2007
		Soil Vapor Extraction	VOCs are extracted from the unsaturated zone using vacuum pumps; also used with active volatilization of VOCs from groundwater.	**Eliminated** – retained in SulTech, 2007 but not for ROCs
		Manual screening	Manual screening of excavated soil and material to separate the soil and material exceeding the cleanup standard from the soil below the cleanup standard. This may be accomplished by soil sampling and analyses in the field.	**Retained** for alternative development.
	Thermal Treatment	Incineration	Volatilization and combustion of soil contaminants.	**Eliminated** – eliminated in SulTech, 2007
		Low Temperature thermal desorption	Volatilization of organic contaminants well below oxidation temperatures.	**Eliminated** – eliminated in SulTech, 2007

TABLE 4-2

IDENTIFICATION AND SCREENING OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology Type	Remedial Technology Process Option	Technology Process Option Description	Screening Comments
Containment	Covers	Soil Covers	Placement of a cover over contaminated soil that will meet the RAO of not exceeding the 10^{-6} to 10^{-4} ELCR risk range	**Retained** – effective for ROCs; easily and quickly implemented; moderate cost
		Asphalt or Concrete Covers	Placement of a cover over contaminated soil that will meet the RAO of not exceeding the 10^{-6} to 10^{-4} ELCR risk range	**Retained** – effective for ROCs; easily and quickly implemented; moderate cost
		Offshore Breakwater	Pervious dams of rocks supported by existing material, faced with large armor units, and provided with a toe to initiate wave breaking	**Eliminated** – eliminated by SulTech, 2007
		Shoreline Sheet-Pile Wall	Wall of corrosion-resistant sheet pile with riprap toe-erosion protection, driven into the shoreline and supported by sufficient pile depth and corrosion-resistant tiebacks	**Retained** – retained for ROCs; alternative retained in SulTech, 2007
		Shoreline Enhancement	Amendment of existing riprap along shoreline	**Retained** – retained for ROCs; alternative retained in SulTech, 2007
		Shoreline Revetment	Placement of an erosion-control structure consisting of riprap, large armor units, gabions, articulating concrete mats, or engineered concrete structures along the shoreline	**Retained** – retained for ROCs; alternative retained in SulTech, 2007

Notes:

ELCR – excess lifetime carcinogenic risk
NCP – National Oil and Hazardous Substances Pollution Contingency Plan
RAO – Remedial Action Objective
ROC – radionuclide of concern
ROD – Record of Decision
VOC – volatile organic compound

TABLE 4-3

IDENTIFICATION AND SCREENING OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology Type	Process Option	Description	Screening Comments
No action	Not Applicable	Not Applicable	No Action	**Retained** – required by NCP
Institutional Controls	Institutional Controls	Institutional Controls	Prohibits activities that could spread groundwater contamination by requiring locked well caps and secured utility access covers and requiring identifying and securing any additional conduit where potential receptors could be exposed to the groundwater; requires posted signs and locked doors to prohibit occupancy of existing buildings or other enclosures where there is unacceptable risk from the vapor intrusion pathway; requires vapor barriers for new construction in areas of unacceptable risk. Prohibits extraction and use of groundwater at the site, except actions performed in accordance with site health and safety requirements; allows only designated land use in accordance with the proposed redevelopment plan. Prohibits certain type of construction and development based on designated land use, and must be in accordance with the land use restrictions; includes criteria during and after development to assure that mitigated exposure conditions to groundwater and to VOCs from the vapor intrusion pathway are maintained or modified for continued protection for the receptors.	**Retained** – easily implemented and effective; prevents exposure to ROCs
Treatment	Passive	Monitoring	Groundwater is sampled and analyzed for ROCs; results are evaluated and reported to assess if ROCs are in aquifer and migration of the contaminants to potential exposure points.	**Retained** – easily implemented; effective for all ROCs at low concentrations; low cost; slow results
		Natural recovery	ROCs are allowed to naturally attenuate via decay, dispersion, dilution, or adsorption; requires monitoring to assess recovery rates and success.	**Retained** – easily implemented; effective for all ROCs at low concentrations; low cost; slow results
	Ex-Situ Pump and Treat	Chemical, physical, or biological treatment	Vertical or horizontal wells are pumped to extract contaminated groundwater from the saturated zone; extracted groundwater is treated through chemical, physical, or biological processes; treated water is released to the surface, to surface water, or to a wastewater treatment plant or is re-injected	**Eliminated** – effective for all chemicals, but not effective for ROCs; high O&M cost; may have slow results

TABLE 4-3

IDENTIFICATION AND SCREENING OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology Type	Process Option	Description	Screening Comments
		Dual Phase Extraction	Vertical wells are pumped to extract contaminated groundwater, and are under negative pressure to extract volatile contaminants for the water surface, capillary fringe, and the vadose zone soils; extracted groundwater and vapors are treated through chemical, physical, or biological processes.	**Eliminated** – mostly effective for VOC chemicals not ROCs; requires high level of effort to implement; high O&M cost; may have slow results
	In-Situ Biological Treatment	Aerobic and Anaerobic Bioremediation	Electron donors, electron acceptors, nutrients, and possibly microorganisms are injected into the contaminated groundwater to create or enhance aqueous biological activity that degrades the contaminants to less toxic or mineralized compounds requires monitoring.	**Eliminated** – Not effective for ROCs and retained by SulTech, 2007
		Phytoremediation	Uses plant uptake to remove, transfer, stabilize, and destroy organic/inorganic chemicals in groundwater; requires monitoring to assess remedial progress.	**Eliminated** – not retained; alternative eliminated in SulTech, 2007
	In-Situ Physical/ Chemical Treatment	Chemical Oxidation	Chemicals such as hydrogen peroxide, potassium permanganate, or Fenton's reagent are injected into the contaminated groundwater to enhance the oxidation state of the aquifer, chemically altering dissolved contaminants to less toxic compounds or precipitants.	**Eliminated** – not retained; alternative retained in SulTech, 2007
		Chemical Reduction	Chemicals such a zero-valent iron, are injected into the contaminated groundwater to enhance the reduction state of the aquifer, chemically altering dissolved contaminants to less toxic compounds or precipitants.	**Eliminated** – not retained; alternative retained in SulTech, 2007
		Electrokinetic Separation	Induced electronic current creates an acid front (low pH) at the anode and a base front (high pH) at the cathode; acidic conditions mobilize metal contaminants for transport and collection at the cathode.	**Eliminated** – not retained; alternative eliminated in SulTech, 2007
		Air Sparging with SVE	Air is injected into the aquifer to mobilize volatile organic chemicals into the unsaturated vadose zone soil; volatile organic chemicals are extracted from the soils with SVE system.	**Eliminated** – not retained; alternative eliminated in SulTech, 2007
		Ozone Sparging with SVE	Ozone is injected into the aquifer to mobilize volatile chemicals into the unsaturated vadose zone soil and create a highly oxygenized environment; mobilized chemicals are extracted from the soils with SVE system.	**Eliminated** – not retained; alternative eliminated in SulTech, 2007

TABLE 4-3

IDENTIFICATION AND SCREENING OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology Type	Process Option	Description	Screening Comments
		Permeable Reactive Barriers	Passive reactive treatment walls are installed across the flow path of a contaminant plume, allowing the water portion of the plume to passively move through the wall; these walls allow the water to pass while prohibiting movement of contaminants by employing agents.	**Eliminated** – not retained; alternative eliminated in SulTech, 2007
Removal	Pump and Dispose Groundwater contaminants	Pumping	Large volumes of groundwater are pumped from the aquifer to capture the contaminated plume; extracted groundwater is either released to a wastewater disposal facility or is hauled off site for disposal.	**Eliminated** – not retained; alternative eliminated in SulTech, 2007
Containment	Slurry Wall	Low-Permeability Wall	Install a low-permeability material, such as bentonite, in a trench or through well injections around the perimeter of the plume to stop groundwater flow and prevent migration of contaminants.	**Eliminated** – not retained; alternative eliminated in SulTech, 2007
	Vapor Barriers	Epoxy Coating	The floor of the building is sealed with an epoxy-based sealant, providing a physical barrier to vapor migration into buildings.	**Eliminated** – not retained; alternative eliminated in SulTech, 2007
		Sub-slab Depressurization	Blowers and vapor collection points are installed below the building to maintain a negative pressure gradient and prevent vapor intrusion.	**Eliminated** – not retained; alternative eliminated in SulTech, 2007
		Raised-floor System	A new floor is installed above the building slab foundation and a depressurization system is installed between the floors to maintain a negative pressure gradient and prevent vapor intrusion.	**Eliminated** – not retained; alternative eliminated in SulTech, 2007

Notes:

NCP – National Oil and Hazardous Substances Pollution Contingency Plan
O&M – Operations and Maintenance
ROC – radionuclide of concern
SVE – soil vapor extraction
VOC – volatile organic compound

TABLE 4-4

IDENTIFICATION AND SCREENING OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR STRUCTURES

General Response Action	Remedial Technology Type	Process Option	Description	Screening Comments
No action	Not Applicable	Not Applicable	No Action	**Retained** – required by NCP
Removal	Scabbling	Scabbling	Removal of contaminated structural materials with the ROC above cleanup goals	**Retained** – effective; easily implemented; moderate cost
	Demolition	Demolition	Removal of contaminated building materials with the ROC above cleanup goals	**Retained** – effective; easily implemented; moderate cost
		Off-Site Disposal	Disposal of excavated radioactively contaminated soil and material into a facility licensed to receive low-level radioactive waste	**Retained** – effective; easily and quickly implemented; permanent remedy; high cost

Notes:

NCP – National Oil and Hazardous Substances Pollution Contingency Plan
ROC – radionuclide of concern

TABLE 4-5

ANALYSIS OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR SOILS AND STRUCTURES

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Screening Comments
SOILS							
No Action	Not Applicable	Not Applicable	No Action	Does not achieve Remedial Action Objectives	Not acceptable to local government or public	None	Retained, required by NCP
Institutional Controls	Institutional Controls	Institutional Controls	Allows fencing, barriers, and posting signs to restrict land use where there is exposure to potentially contaminated soil. Prohibits activities not specified for the designated land use; prohibits growing produce in native soil. Restricts the use of the parcel to those re-uses identified at the time the ROD amendment is signed; includes criteria during and after future development to assure that mitigated exposure conditions are maintained such as covers, barriers, or other engineering controls.	Effective at preventing exposure of receptors to contamination, especially when used in combination with other options; does not reduce volume or toxicity of contamination	Requires legal documents and authority to enforce restrictions, easily implemented	Low Cost	Retained, easily implemented and effective, usually required to restrict activity based on land use

TABLE 4-5

ANALYSIS OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR SOILS AND STRUCTURES

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Screening Comments
Removal	Excavation	Conventional excavation	Excavation of contaminants, soil and materials with the ROC concentration above the cleanup goals	Effective at removing contamination and preventing long-term exposure to contamination; may expose workers and environment to contaminants during implementation; uses conventional construction methods; proven technology	Easily implemented for defined areas of contamination; easily implemented for ROCs; may need to excavate to 10 feet bgs	Moderate cost (based on previous excavations at Parcel B)	**Retained** – effective for ROCs and quickly implemented; moderate cost
	Off-Site Disposal	Disposal of excavated radioactively contaminated soil and material into a facility licensed to receive low-level radioactive waste.	Transport and disposal of soils at a permitted treatment and disposal facility	Effective at preventing exposure of receptors to contamination; does not reduce total amount of contamination; may expose workers and environment to contaminants during implementation; conventional method	Requires appropriate transportation permits and waste characterization; easily implemented	High cost	**Retained** – effective; easily and quickly implemented; permanent remedy; high cost

TABLE 4-5

ANALYSIS OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR SOILS AND STRUCTURES

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Screening Comments
Containment	Covers	Soil, Asphalt, or Concrete Cover	Placement of a cover over contaminated soil, prevents contact with contamination	Effective at preventing exposure of receptors to contamination; must be used with land-use controls to maintain protectiveness; susceptible to weathering and cracking	Paved areas can be easily maintained using conventional methods; soil or asphalt cover could be used in areas currently unpaved; easily implemented	Moderate cost	**Retained** - for areas that are paved or require paving to achieve planned land uses; can be used with a soil cover
		Manual screening	Manual screening of excavated soil and material to separate the soil and material exceeding the cleanup standard from the soil below the cleanup standard, which may be accomplished by soil sampling and analyses in the field	Effective at preventing exposure of receptors to contamination; reduces the total amount of contamination; may expose workers and environment to contaminants during implementation; conventional method	Requires appropriate equipment, instrumentation, and trained personnel	High cost	**Retained** for fill areas that need to be excavated

TABLE 4-5

ANALYSIS OF GENERAL RESPONSE ACTIONS AND PROCESS OPTIONS FOR SOILS AND STRUCTURES

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Screening Comments
STRUCTURES							
No Action	Not Applicable	Not Applicable	No Action	Does not achieve Remedial Action Objectives	Not acceptable to local government or public	None	Retained, required by NCP
Treatment	Removal	Scabbling	Scabbling	Removal of contaminated structural materials with the ROC above cleanup goals	Easily implemented	Moderate cost	Retained; removes specific area contamination
		Demolition	Demolition	Removal of contaminated building materials with the ROC above cleanup goals	Easily implemented	Moderate cost	Retained; removes large area contamination
			Off-Site Disposal	Disposal of excavated radioactively contaminated soil and material into a facility licensed to receive low-level radioactive waste	Easily implemented	High cost	Retained; effective; quickly implemented; permanent remedy

Notes:

bgs – below ground surface
NCP – National Oil and Hazardous Substances Pollution Contingency Plan
ROC – radionuclide of concern
ROD – Record of Decision

TABLE 6-1

COMPARATIVE ANALYSIS OF ALTERNATIVES SUMMARY

Alternatives	Overall Protection	ARAR Compliance	Long-term Effectiveness	Reduction of Toxicity, Mobility, Volume through Treatment	Short-term Effectiveness	Implementability	Cost	Overall Rank
SOIL ALTERNATIVES								
S-1: No Action	Not protective	Not Applicable	Not Acceptable	Poor	Very Good	Excellent	$0	Not Acceptable
S-2: ICs, Maintained Landscaping and Shoreline Revetment	Protective	Meets	Good	Poor	Good	Very Good	$70,000[a]	Good
S-3: Excavation, Methane and Mercury Source Removal, Disposal, Maintained Landscaping, ICs, and Shoreline Revetment	Protective	Meets	Good	Poor	Good	Very Good	$547,000[a]	Good
S-4: Covers, Methane and Mercury Source Removal, Disposal, ICs, and Shoreline Revetment	Protective	Meets	Very Good	Poor	Very Good	Very Good	$547,000[a]	Very Good
S-5: Excavation, Methane and Mercury Source Removal, Disposal, Covers, Soil Vapor Extraction, ICs, and Shoreline Revetment	Protective	Meets	Excellent	Good	Very Good	Very Good	$547,000[a]	Excellent

TABLE 6-1

COMPARATIVE ANALYSIS OF ALTERNATIVES SUMMARY

Alternatives	Overall Protection	ARAR Compliance	Long-term Effectiveness	Reduction of Toxicity, Mobility, Volume through Treatment	Short-term Effectiveness	Implementability	Cost	Overall Rank
GROUNDWATER ALTERNATIVES								
GW-1: No Action	Not protective	Not Applicable	Poor	Poor	Very Good	Excellent	$0	Not Acceptable
GW-2: Long-term Monitoring and ICs	Protective	Meets	Good	Poor	Excellent	Excellent	$280,000[a]	Good
GW-3A: In-Situ Treatment with Biological Substrate Injection, Reduced Groundwater Monitoring, and ICs	Protective	Meets	Excellent	Excellent	Very Good	Very Good	$280,000[a]	Excellent
GW-3B: In-Situ Treatment with Zero-valent iron Injection, Reduced Groundwater Monitoring, and ICs	Protective	Meets	Very Good	Excellent	Very Good	Very Good	$280,000[a]	Very Good
RADIOLOGICALLY-IMPACTED SITES ALTERNATIVES								
R-1: No Action	Not protective	Not Applicable	Poor	Poor	Very Good	Very Good	$0	Not Acceptable
R-2: Surveys, Decontamination, Disposal, Release, and ICs	Protective	Meets	Good	Poor	Very Good	Good	$28,892,000	Good
R-3: Survey, Decontamination, Disposal, Release, Close In-Place, and ICs	Protective	Meets	Very Good	Poor	Very Good	Very Good	$29,603,000	Very Good

Notes:

a – Additional cost associated with alternative to account for radionuclides of concern
ARAR – applicable or relevant and appropriate requirement
IC – institutional control

FIGURES

Figure ES-1: Ranking of Remedial Alternatives For Soil, Groundwater, and Radiologically-Impacted Sites

	Overall Protection of Human Helath and the Environment	Compliance with ARARs	Long-Term Effectivness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost ($ Million)	Overall Rank by Alternative
Soil Alternatives								
Alternaitve S-1: No Action	Not Protective	Not Applicable	○	◐	◑	●		○
Alternative S-2: Institutional Controls, Maintained Landscaping, and Shoreline Revetment	Protective	Meets ARARs	◐	◐	◑	◑	0.07[a]	◐
Alternative S-3: Excavation, Methane and Mercury Source Removal, Disposal, Maintained Landscaping, Institutional Controls, and Shoreline Revetment	Protective	Meets ARARs	◐	◑	◐	◑	0.55[a]	◑
Alternative S-4: Covers, Methane and Mercury Source Removal, Disposal, Institutional Controls, and Shoreline Revetment	Protective	Meets ARARs	◑	◐	◑	◑	0.55[a]	◑
Alternative S-5: Excavation, Methane and Mercury Source Removal, Disposal, Covers, SVE, Institutional Controls, and Shoreline Revetment	Protective	Meets ARARs	●	◑	◑	◑	0.55[a]	●
Groundwater Alternatives								
Alternative GW-1: No Action	Not Protective	Not Applicable	◐	◐	◑	●	0	○
Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls	Protective	Meets ARARs	◐	◐	◑	●	0.28[a]	◐
Alternative GW-3A: In Situ Groundwater Treatment with Biological Substrate Injection, Reduced Groundwater Monitoring, and Institutional Controls	Protective	Meets ARARs	●	●	◑	◑	0.28[a]	●
Alternative GW-3B: In Situ Treatment with ZVI Injection, Reduced Groundwater Monitoring, and Institutional Controls	Protective	Meets ARARs	◑	●	◑	◑	0.28[a]	◑
Radiologically-Impacted Sites Alternatives								
Alternative R-1: No Action	Not Protective	Not Applicable	○	○	◑	◑	0	○
Alternative R-2: Survey, Decontamination, Disposal, Release, and Institutional Controls	Protective	Meets ARARs	◐	◐	◑	◐	28.9	◐
Alternative R-3: Survey, Decontamination, Disposal, Release, Close In-Place, and Institutional Controls	Protective	Meets ARARs	◑	◐	◑	◑	29.6	◑

Legend

○ Not acceptable

◐ Poor

◑ Good

◑ Very Good

● Excellent

ARAR Applicable or relevant and appropriate requirement
SVE Soil vapor extraction
ZVI Zero-valent iron
a - Additional cost to the TMSRA estimated cost for the alternative

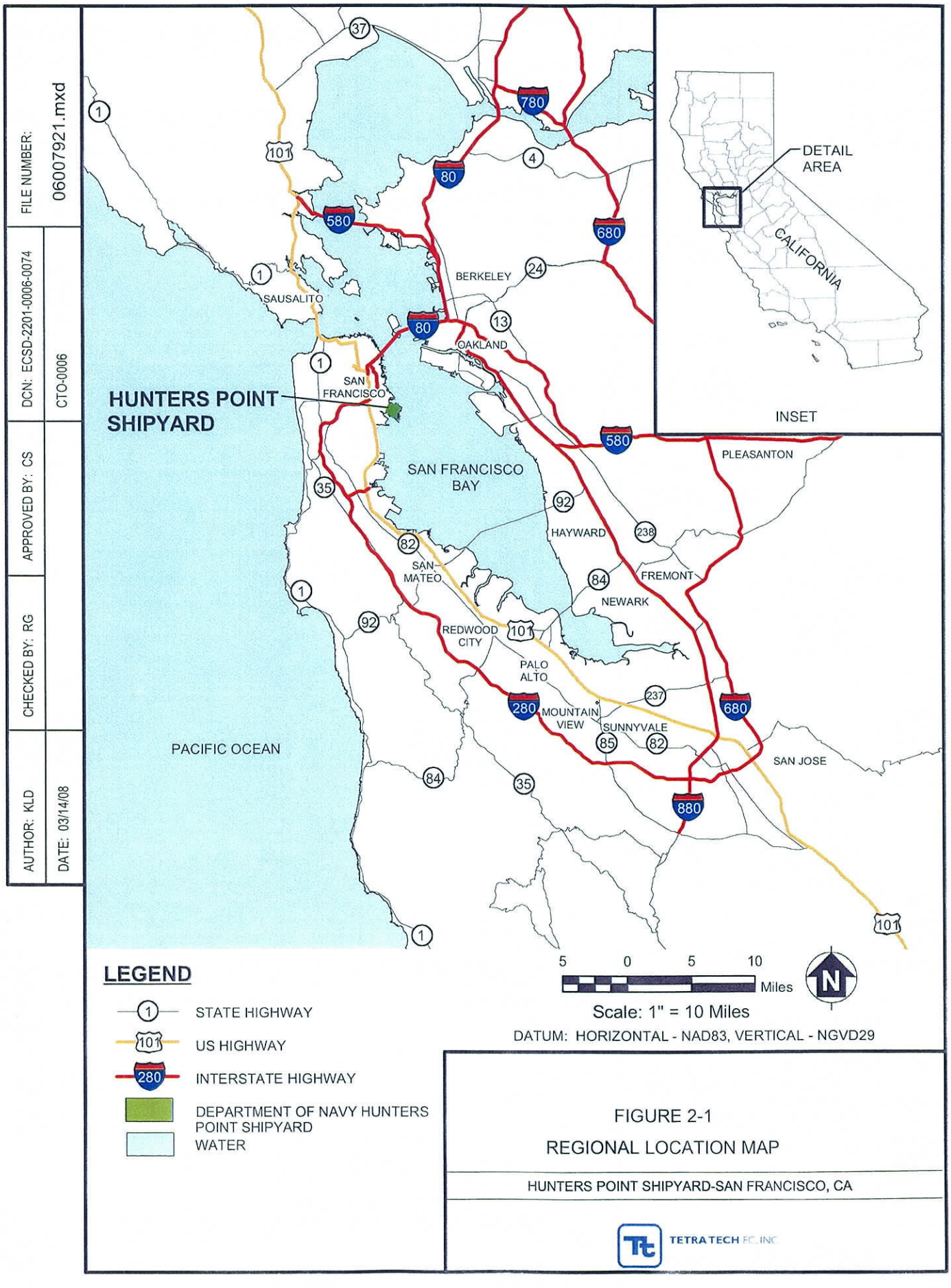


FIGURE 2-1

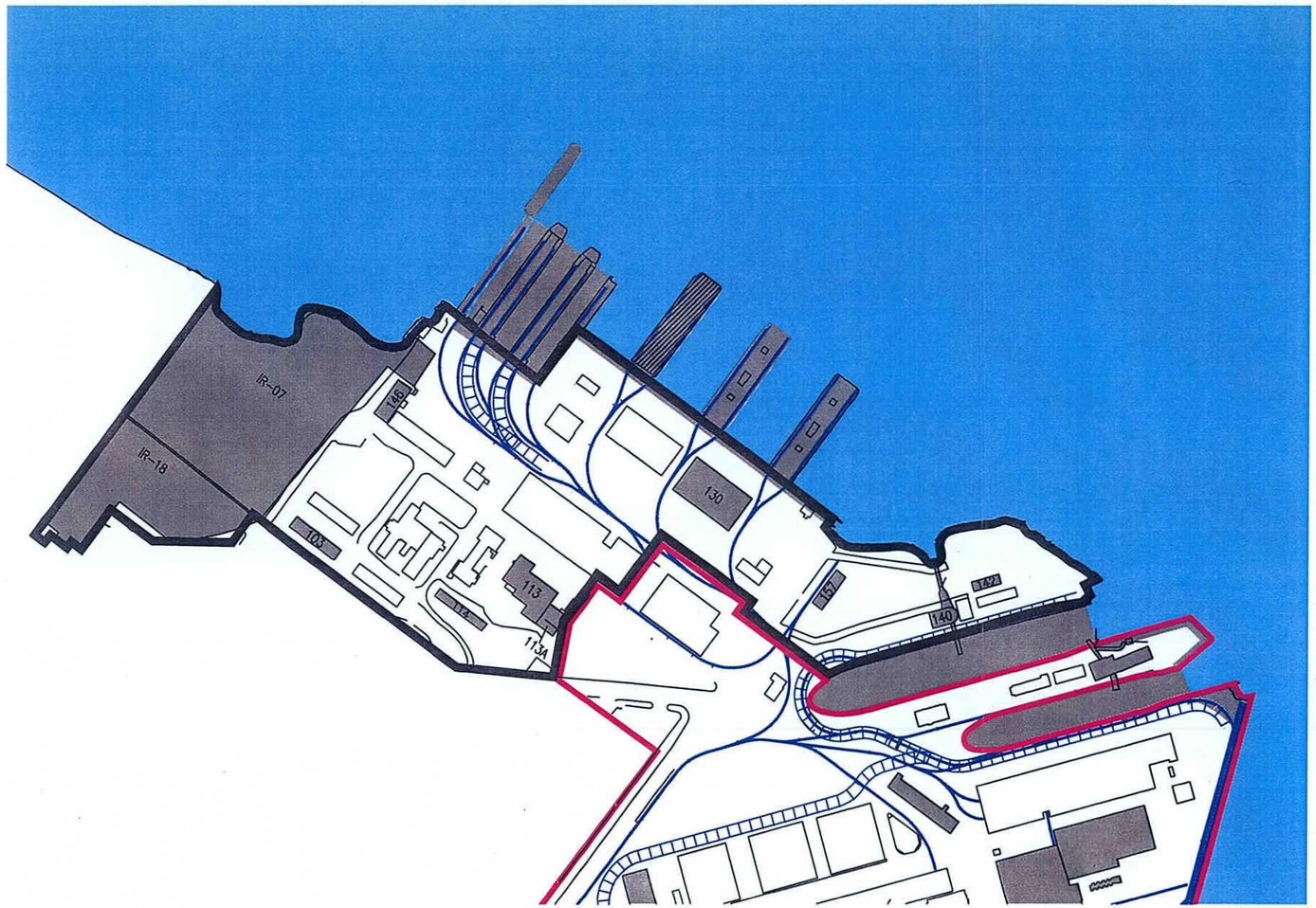
REGIONAL LOCATION MAP

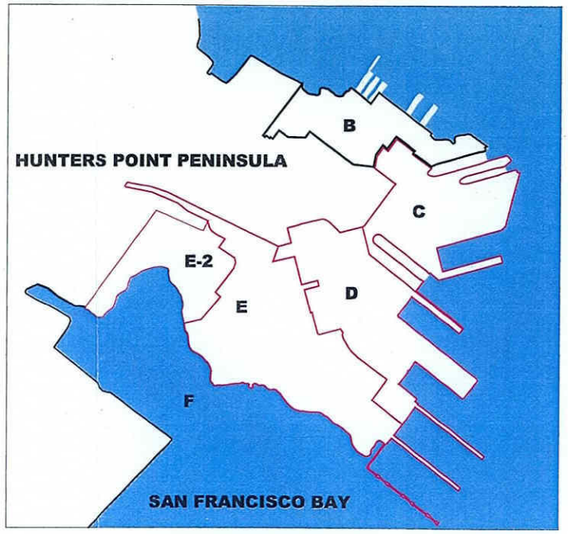
HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC, INC

DRAWN BY: RP	CHECKED BY: RB	APPROVED BY: CS	DCN: ECSD-2201-0006-0074
DATE: 03/14/08			CTO 0006

DRAWING NO: 06007922-R4.DWG





LOCATION MAP

LEGEND

- OTHER PARCEL BOUNDARIES
- PARCEL B BOUNDARY
- IMPACTED BUILDINGS OR SITES

N

250 0 250 500

BASE REALIGNMENT AND CLOSURE PROGRAM MANAGEMENT
OFFICE WEST SAN DIEGO, CA

FIGURE 2-2
PARCEL B BOUNDARY WITHIN
HUNTERS POINT SHIPYARD

HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC, INC.

06007922-R4.DWG
PLOT/UPDATE: SEP 24 2007

SAN FRANCISCO BAY

SAN FRANCISCO BAY

IR-07

IR-18

Block 1

Block 2

Block 3

Block 4

Block 5

Block 6

Block 7

Block 8

Block 9

Block 12

Block 15

Block 16

Block BOS-1

Block BOS-2

Block BOS-3

ARIC refers only to the deep pump shaft below Building 140

INNES AVE.

DONAHUE ST.

HUDSON AVE.

GALVEZ AVE.

FRIEDELL ST.

JERROLD AVE.

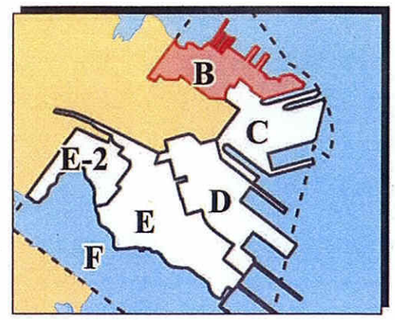
COLEMAN ST.

LOCKWOOD ST.

ROBINSON ST.

FISHER AVE.

VAN KEUREN AVE.



Location Map

- Radiologically Impacted Sites
- Road

Parcel B Redevelopment Blocks:

- Research and Development
- Mixed Use
- Open Space
- Educational/Cultural
- 128 Parcel Boundary
- Non-Navy Property
- Building
- San Francisco Bay
- Area Likely Requiring ICs
  ARICs shown reflect implementation of either Alternative R-2 or R-3

Notes:

Redevelopment blocks developed for the TMSRA based on "Hunters Point Shipyard Redevelopment Plan" San Francisco Redevelopment Agency. July 14, 1997.

TMSRA Technical memorandum in support of a record of decision amendment

N

0 300 600

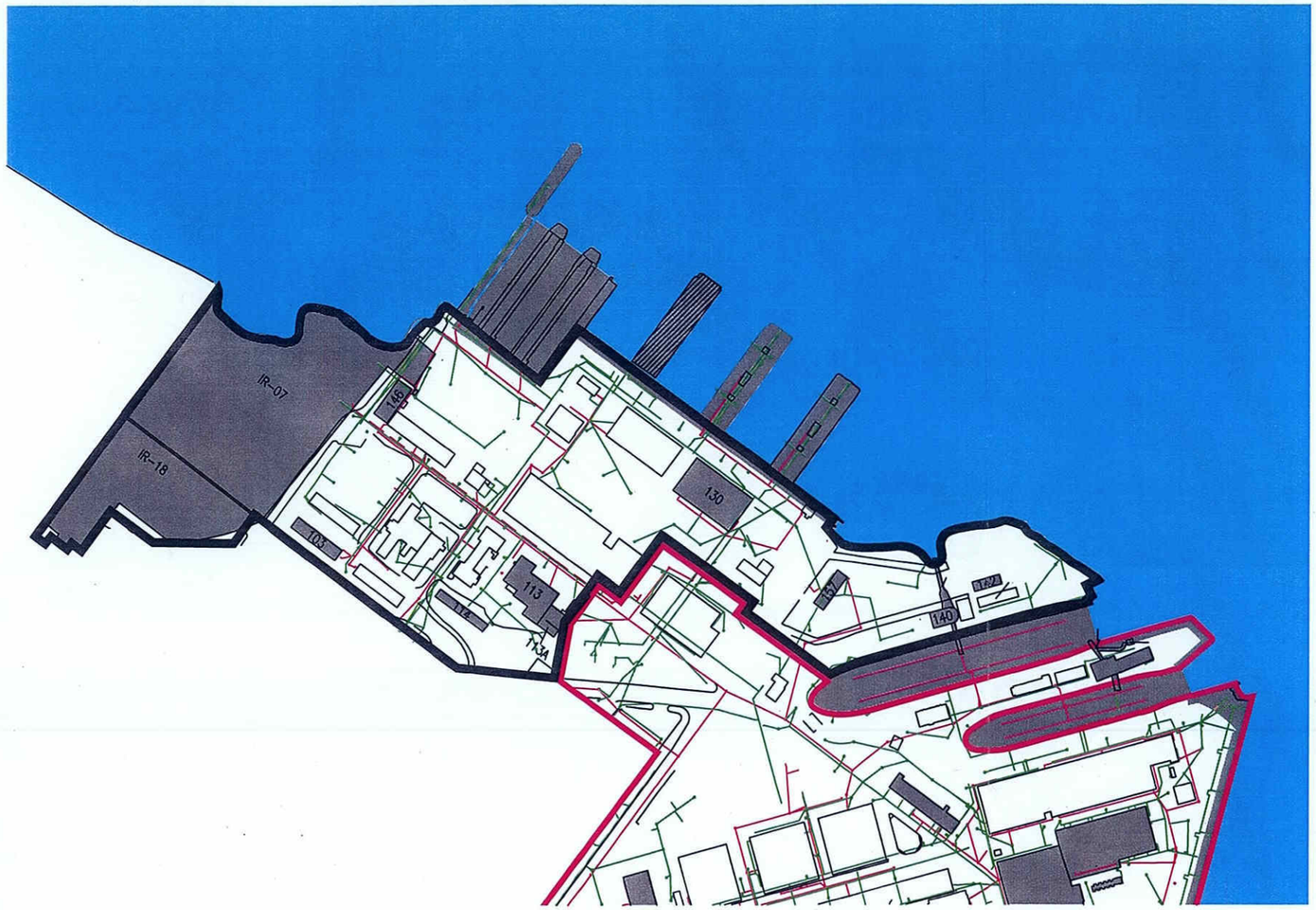
Scale in Feet

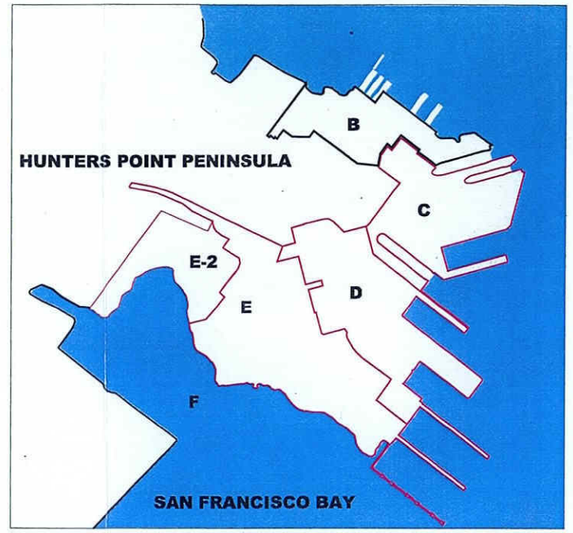
TETRA TECH EC, INC.

Hunters Point Shipyard, San Francisco, California

U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 2-3
PARCEL B IMPACTED SITES, REDEVELOPMENT BLOCKS, AND PLANNED REUSE





LOCATION MAP

LEGEND

- OTHER PARCEL BOUNDARIES
- PARCEL B BOUNDARY
- IMPACTED BUILDINGS OR SITES
- SANITARY SEWERS
- STORMDRAIN LINES

250 0 250 500

BASE REALIGNMENT AND CLOSURE PROGRAM MANAGEMENT
OFFICE WEST SAN DIEGO, CA

FIGURE 2-4
PARCEL B SANITARY SEWERS
AND STORMDRAIN LINES

HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWN BY: RP
DATE: 03/14/08

CHECKED BY: RB

APPROVED BY: CS

DCN: ECSD-2201-0006-0074
CTO 0006

DRAWING NO:
06007924-R1.DWG

PLOT/UPDATE: SEP 24 2007
06007924-R1.DWG

APPENDIX A

PARCEL B RISK SCREENING ANALYSIS

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

CONTRACT NO. N62473-06-D-2201
CTO NO. 0006

APPENDIX A

FINAL

PARCEL B RADIOLOGICAL RISK SCREENING ANALYSIS March 14, 2008

PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

DCN: ECSD-2201-0006-0074

TETRA TECH EC, INC.
1230 Columbia Street, Suite 750
San Diego, CA 92101-8536

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ATTACHMENTS

ABBREVIATIONS AND ACRONYMS

^{137}Cs	cesium-137
^{226}Ra	radium-226
^{239}Pu	plutonium-239
^{60}Co	cobalt-60
^{90}Sr	strontium-90
cm^2	square centimeter
DoD	Department of Defense
dpm	disintegration per minute
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
HPS	Hunters Point Shipyard
m^2	square meters
m^3/yr	cubic meters per year
NAVSEA	Naval Sea Systems Command
NRC	Nuclear Regulatory Commission
pCi/g	picocurie per gram
RAGS	Risk Assessment Guidance for Superfund
RESRAD	Residual Radioactivity (Model)
ROC	radionuclide of concern
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment

1.0 PURPOSE

The Department of the Navy, U.S. Environmental Protection Agency (EPA), and Department of Toxic Substances Control (DTSC) held a number of focused meetings in 2004 and agreed upon risk assessment methodologies for soil and groundwater that were used for the human-health risk-assessment in the Parcel B Technical Memorandum in Support of a Record of Decision Amendment (TMSRA) (SulTech, 2006). These methodologies were applied to the analyses discussed in this appendix.

This appendix presents the methodology and evaluations used to estimate the dose and risk to future Parcel B residents and construction workers. The objectives of this appendix are to:

- Identify the critical exposure pathways and radiological contaminants that pose primary health concerns
- Identify the exposure pathways and radiological contaminants that pose little or no threat to human health
- Estimate the potential dose and risks to human health due to radiological contaminants associated with potential future land-use scenarios

The remainder of this appendix is organized as follows:

- Section 2.0 presents an overview of the methodology used for the risk analysis.
- Section 3.0 discusses the conceptual site model for Parcel B.
- Section 4.0 presents the data evaluation and identification of radionuclides of concern (ROC).
- Section 5.0 presents the exposure assessment.
- Section 6.0 presents the uncertainty analysis.
- Section 7.0 presents the references used for this analysis.

Tables, figures, and attachments are presented after Section 7.0.

2.0 RADIOLOGICAL RISK ASSESSMENT METHODOLOGY

The computer codes Residual Radioactive (RESRAD) Model (Department of Defense [DoD], et al., 2000) and RESRAD-BUILD (Nuclear Regulatory Commission [NRC], 2000) were used to perform dose and risk modeling of radiologically-impacted sites at Parcel B. RESRAD-BUILD was used to model the impacted buildings (e.g., 103, 113, 113A, 130, 140, 146). RESRAD was used to model the risk associated with impacted land areas (e.g., former building sites 142 and 157) and fill areas (e.g., Installation Restoration Sites 07 and 18). Both RESRAD and RESRAD-BUILD use the isotopes specified as radionuclides of interest and automatically include the long-lived daughter products of these isotopes.

RESRAD and RESRAD-BUILD were used to analyze the exposure scenarios that match planned reuse (San Francisco Redevelopment Agency, 1997). The majority of the input parameters for both RESRAD and RESRAD-BUILD were left as default except where noted. Based upon the results for a critical receptor scenario analysis, all results were run using the bounding resident adult scenario. The following paragraphs apply only to the critical receptor analysis, as noted above, all calculations used for dose and additive risk were run using RESRAD defaults.

The following discussion identifies the best processes to match each of the receptor-specific parameters for TMSRA non-radiological risk and RESRAD analyses. Unfortunately due to the manner in which indoor and outdoor fractions are used in RESRAD and how they relate to exposure time and frequency as used in the TMSRA, it is impossible to implement all the steps necessary to perform a completely matching calculation.

The difficulty arises from the fact that the RESRAD indoor and outdoor fractions are pervasive across all calculations. Inhalation, soil ingestion, and exposure calculations all use the indoor and outdoor fractions. Inhalation and soil ingestion rates input into RESRAD are total annual rates regardless of location on or off site, whereas rates in the TMSRA correspond to rates only for time spent on site. There are no indications as to what the receptor does off site in the TMSRA. In order to match the total intake quantities (air or soil) either the intake rates or the total on-site fraction must be modified in RESRAD. In order to match the exposure period, the only mechanism available for RESRAD is to adjust the total on-site fraction. Therefore, when matching intake quantities, the preferential method is to modify the intake rates since changes to the on-site fraction would prohibit effective matching of exposure period.

As noted in Section 2.1.5 regarding the inhalation rate, there are cases where the required changes to the intake values would put a parameter outside of RESRAD's accepted range of values for that parameter. In order to estimate the significance of this limitation, scoping calculations were performed using RESRAD default parameters, a worst-case source term with all ROCs in Parcel B present at release limits, and the appropriate pathways active. The results of this analysis indicated that at calculations times out to 300 years, greater than 90 percent of the

dose (with a peak of almost 97 percent at time zero) is due to direct radiation. The second-highest contributor ranging from 2.5 to 7.5 percent is from soil ingestion, while inhalation ranges from a fraction of a percent to just over 1 percent of the total dose. Fortunately the cases where the intake parameters are outside of the RESRAD limits apply only for inhalation rates for the construction and industrial workers. Thus there are virtually no consequences of having to set the inhalation rate lower than the value needed to give an exact match with the TMSRA in these cases.

Table A.2-1 summarizes changes to RESRAD default parameters necessary to make the receptor scenarios more closely match the TMSRA cases. All other RESRAD parameters were left at default values. The approach taken with comparable TMSRA parameters is described in the following sections of this appendix.

2.1 RESRAD

The RESRAD (NRC, 2000) code is used to estimate the potential risk to an individual from exposure to residual radionuclides in soil or soil-like media. It was used to evaluate the risk associated with impacted soil areas in Parcel B. Site specific results were modeled using default RESRAD parameters for all values except for contaminated area size as noted in Section 5.2.

When looking at various receptor scenarios, the goal of the RESRAD risk modeling approach was to be as consistent as possible with assumptions and inputs used in the TMSRA non-radiological human health risk assessment. To achieve this goal the development of representative parameters for receptor scenarios other than the RESRAD default was required. This was achieved by following the guidance of the EPA Exposure Factors Handbook and the Risk Assessment Guidance for Superfund (RAGS) documents. These guides were also used in development of input parameters for the TMSRA human health risk assessment. Receptor-specific RESRAD values were selected from these documents for recreational, construction, and industrial users in addition to the default resident values. The simplest approach to modeling these scenarios would have been to simply use the values suggested by previous researchers for the various RESRAD receptor types. However, the basis of the receptors defined in the TMSRA are not based upon the same assumptions used in developing the RESRAD receptor types. In order to achieve the best correlation it was necessary to adjust each of the parameters based upon receptor-specific information.

The differences between the parameters for the various receptors essentially are limited to variation among:

- Averaging time for noncarcinogens
- Body weight
- Body surface area
- Exposure duration

- Exposure frequency
- Exposure time
- Inhalation rate
- Soil adherence factor
- Soil ingestion rate

The following section provides an evaluation of the sensitivity of each of these parameters when used in performing calculations with RESRAD that directly parallel the exposure scenarios defined in the TMSRA. This evaluation presents the chemical analysis parameter(s) and indicates the equivalent RESRAD parameter(s). Where possible, like parameters are grouped together.

2.1.1 Averaging Time for Non-Carcinogens and Body Weight

From a chemical analysis standpoint the averaging times are used to distribute the harmful effects of exposure for means of common comparison. EPA guidance assumes that all doses are essentially normalized into an average daily dose. By use of an averaging time, a long-term low dose is just as unfavorable as a short-term high dose. Body weight is a necessary component in order to obtain doses in terms of milligrams per kilogram of body weight per day.

When performing radiological calculations; however, neither one of these factors is included in risk determination. This guidance is given explicitly in Chapter 10 of the RAGS document. The rationale is that the determination of dose conversion factors for radionuclide exposure is performed in a different manner than slope factors for chemical exposure. In essence the body weight and averaging time factors are already included or unnecessary because of the manner in which the calculations are performed. Therefore, consistency between the averaging time and receptor body weight parameters in the TMSRA and RESRAD is not necessary.

2.1.2 Body Surface Area and Soil Adherence Factor

The body surface area parameter is used in chemical analysis for the dermal contact pathway. Since radiological analysis does not have a direct contact pathway, there is no corresponding body surface area parameter. Any exposure resulting from direct contact with radiologically contaminated material would be accounted for in the external radiation pathway.

2.1.3 Exposure Frequency and Exposure Time

The exposure frequency and time are used in TMSRA analysis to define the exposure for the various receptors. The exposure time gives the number of hours per day that a receptor is on site and exposed to harmful substances. Exposure frequency specifies the number of days per year that a receptor is at the site. The product of the exposure time and exposure frequency yields the

total number of hours spent on site in a year. For purposes of this discussion, this product shall be referred to as the exposure period.

There are no directly correlated exposure frequency or time parameters in RESRAD. Rather than using these factors explicitly, RESRAD uses parameters for indoor fraction and outdoor fraction. The former accounts for time spent inside a building at the site while the latter accounts for time on site but outside. When added together these two values give the total on-site fraction. The primary difference between time indoors and time outdoors from a calculational standpoint is that indoor time accounts for additional shielding from direct radiation offered by the building's materials. In order to be conservative, however, the total on-site fraction is allocated to the outdoor time fraction since the resulting doses are higher resulting in a high risk number.

The indoor and outdoor fractions are unitless parameters and thus can be applied across any given time period. Using the RESRAD default indoor and outdoor fractions of 0.5 and 0.25, respectively, a default RESRAD receptor spends 18 hours per day on site. RESRAD uses a 365-day-year and there is no means of adjusting the number of days per year. Therefore, the default receptor spends a total time of 6,570 hours on site a year.

In order to match the exposure frequency in the TMSRA, the total on-site fraction is adjusted such that the exposure period (total number of hours of exposure per year) is consistent with the parameters from the TMSRA. The technique of matching total annual hours on site is consistent with suggestions given in the RESRAD manual for modeling receptors with different exposure scenarios than the default receptor.

2.1.4 Exposure Duration

The exposure duration indicates how many total years the receptor will spend on site. By default RESRAD uses a value of 30 years for exposure duration. This parameter is directly modifiable by the user. The Parcel B TMSRA uses values of 1, 6, 24, and 25 years based upon receptor type and age.

2.1.5 Inhalation Rate

The TMSRA analysis uses inhalation rates based upon the receptor scenario and age. Inhalation rates in the TMSRA are given in terms of cubic meters per hour. RESRAD has a user-defined inhalation rate that by default is 8,400 cubic meters per year (m^3/yr). RESRAD contains specialized templates for recreational and industrial workers with inhalation rates of 14,000 m^3/yr and 11,400 m^3/yr, respectively. If the TMSRA inhalation rates are converted to the same units used in RESRAD, rates of 3,679-m^3/yr, 7,270-m^3/yr, and 21,900-m^3/yr are obtained.

At first it would appear that simply using the converted TMSRA rates in RESRAD analyses would yield the desired results. Unfortunately, RESRAD has a maximum annual inhalation rate of 20,000 m^3/yr. This limitation prevented direct matching of the 21,900 m^3/yr rate used in certain

TMSRA cases. Since the inhalation pathway is not a critical pathway for risk, the difference in the annual breathing rate does not yield a significant difference in the estimated risk.

2.1.6 Soil Ingestion Rate

Soil ingestion rates in the TMSRA are given in terms of milligrams of soil per day. RESRAD uses soil ingestion rates in terms of grams of soil per year with a default value of 36.5 grams per year. Similarly to the inhalation rate, the best match is to ensure that the annual soil intake volume is equal for both the TMSRA and RESRAD cases when exposure time and frequency are factored in.

2.2 RESRAD-BUILD

RESRAD-BUILD (NRC, 2000) is a modeling code used to estimate the potential radiological risk to an individual who works or lives in a building with residual radioactive material. It was used to evaluate the risk associated with occupying Parcel B-impacted buildings. The focus of this modeling was to estimate the increased cancer risk associated with any residual radioactive material left in the buildings after the buildings have been surveyed and released. Residual radioactive material is defined as any radioactive material below the residual cleanup goals. RESRAD-BUILD is similar to RESRAD in that the user can construct the exposure scenario by adjusting the input parameters. Typical building exposure scenarios include long-term occupancy (residential and industrial) and short-term occupancy (recreational and construction). The estimated dose can be the total (individual) dose to a single receptor spending time at various locations or the total (collective) dose to a workforce decontaminating the building.

RESRAD-BUILD has several input parameters that are grouped into the categories of building, source, and receptor. Using RESRAD-BUILD, buildings can be modeled as one-, two- or three-room structures. For simplicity of modeling, all buildings were modeled as a single-room structure with a default interior height of 2.5 meters. The room area was set at 100 m^2 for all runs to approximate the typical size of an interior survey unit. The source for each building was modeled as an area source that covered the complete floor area of the building, based on the assumption that the residual radioactive material would be uniformly distributed over the floor surface. The source activity was from the ROCs at the respective release limit. Receptor inputs were taken as the default values and the receptor was located in the middle of the building. All other building parameters used the default input value.

3.0 CONCEPTUAL SITE MODEL

This section presents the conceptual site model for Parcel B radiological risk analysis. The site model provides a summary of the sources of the radionuclide contaminants on site and presents the affected environmental media. Additionally, the potential receptors and pathways through which receptors may receive radiological dose are noted. The conceptual site model for Parcel B is presented in Figure A.3-1, which indicates which computer code was used to model the risk to the indicated receptor by the indicated pathway. Radiological pathways that are not active for this analysis are excluded from the site model.

3.1 SOURCES OF SITE CONTAMINANTS

Details on the historical activities at Parcel B contributing to the existing radiological contamination are presented in Section 2.1.2 of the Radiological Addendum to the TMSRA for Parcel B.

3.2 AFFECTED ENVIRONMENTAL MEDIA

Previous Parcel B activities have introduced radioactive contaminants to land areas and buildings. Contaminated media in the form of discrete radioactive sources as well as distributed contamination from leaks or spills of radioactive material are potentially present at impacted areas of Parcel B. Contamination of building surfaces and existing concrete and asphalt resulting from leaks, spills, and process wastes is also potentially present.

3.3 POTENTIALLY EXPOSED RECEPTORS

The 1997 redevelopment plan identifies planned reuses for the entire Parcel B area. Table A.3-1 shows the impacted areas of Parcel B, the planned reuse, and associated exposure scenario.

The exposure scenario establishes the receptor parameters to be modeled. The potential receptors considered for evaluation were selected to be consistent with the human health risk assessment provided in the TMSRA and are as follows:

- Resident (adult and child)
- Industrial worker (adult)
- Recreational user (adult and child)
- Construction worker (adult)

Although the impacted land areas in Parcel B only fall into the residential and recreational exposure scenarios, all four receptor categories listed above were modeled. These additional evaluations provide information on potential risks for all potential reuses in the event that the redevelopment plan is revised.

3.4 EXPOSURE PATHWAYS

As discussed in the human health risk assessment in the TMSRA, a complete exposure pathway consists of the following four elements:

- A source and mechanism of chemical release
- A retention or transport medium (or media in cases involving transfer of chemicals)
- A point of potential human contact with the contaminated medium (referred to as the exposure point)
- An exposure route (such as ingestion) at the contact point

If any of these elements is missing (except in a case where the source itself is the point of exposure), then the exposure pathway is considered incomplete. For example, if receptor contact with the source or transport medium does not occur, then the exposure pathway is incomplete and is not quantitatively evaluated for risk. Similarly, if human contact with an exposure medium is not possible, the exposure pathway is considered incomplete and is not evaluated.

For the potentially contaminated building surfaces the exposure pathways are external radiation from contaminated surfaces and inhalation of re-suspended contaminated dust.

The exposure pathways for the impacted soils at Parcel B present a more complicated analysis. The complete pathways, based on the four criteria listed above, are external radiation, soil ingestion, and inhalation.

3.4.1 External Radiation Pathway

The external radiation pathway is identified as potentially complete for all receptors. Exposure to external radiation is the result of radiation emanating from radionuclides present in the soil on other contaminated media.

3.4.2 Soil Ingestion Pathway

The soil ingestion pathway is identified as potentially complete for all receptors. This pathway corresponds to direct ingestion of soil.

3.4.3 Inhalation Pathway

The inhalation pathway is identified as potentially complete for all receptors. This pathway corresponds to inhalation of radiologically contaminated dust and soil particles.

3.4.4 Drinking Water Ingestion Pathway

The drinking water ingestion pathway is not identified as a potentially pathway for all receptors. Evaluations of the A-aquifer and the B-aquifer suggest that these aquifers should not be

considered a potential source of drinking water. However, the exposure pathway associated with residential use of groundwater in the B-aquifer was included in the TMSRA because of agreements with the Base Closure Team on the human health risk assessment methodology and are included for consistency. However, to be consistent with the TMSRA the RESRAD modeling was performed with the drinking water pathway included. The soil ROCs transport mechanism from the soil matrix to the groundwater is accounted for with this pathway.

4.0 RADIONUCLIDES OF CONCERN

The radionuclides identified in Table A.4-1 (cesium-137 [^{137}Cs], cobalt-60 [^{60}Co], plutonium-239 [^{239}Pu], radium-226 [^{226}Ra], and strontium-90 [^{90}Sr]) are the constituents of potential concern (or radionuclides of concern) and are called the ROCs at Parcel B. Typically there is no background radioactivity associated with building materials, with the exception of building material made from earthen media (e.g., tiles concrete, stone, etc.). To simplify the RESRAD-BUILD evaluations being performed it is assumed that the impacted buildings in Parcel B do not have materials of construction with naturally occurring elevated levels of radioactivity.

5.0 EXPOSURE ASSESSMENT

The TMSRA provides both total and incremental risk associated with chemical constituents. To combine the chemical risk and radiological risk, the same approach used in the TSMRA to calculate chemical risk must be taken, namely, calculating total risk from ROCs inclusive of background and calculating incremental risk from the ROCs present at levels that do not include background. Of the ROCs for Parcel B only ^{226}Ra is naturally occurring. ^{137}Cs and ^{90}Sr may be present in trace quantities because of fallout resulting from nuclear weapons testing. For the purposes of the radiological modeling the background concentration for the ROCs other than ^{226}Ra are assumed to be essentially zero (i.e., zero picocuries per gram [pCi/g]). The ^{226}Ra background concentration is assumed to be the measured background level of 0.5 pCi/g.

To estimate the total risk from radiologically-impacted buildings, the background concentration of the ROCs are assumed to be zero (i.e., zero disintegration per minute [dpm]/100 square centimeters [cm^2]). This is a reasonable assumption since none of the ROCs are found in building materials except for ^{226}Ra, which can be found in building material made of earthen materials (i.e., cement, ceramic tiles). However, as a conservative modeling measure, the background concentration of ^{226}Ra in building materials is also assumed to be zero.

The risk associated with the impacted site at Parcel B is presented in this section.

5.1 RESRAD-BUILD

To estimate the total risk from impacted buildings the background concentration of the ROCs is assumed to be zero (e.g., zero dpm/100 cm^2). This is a reasonable assumption since none of the ROCs are found in building materials expect for ^{226}Ra, which can be found in building material made of earthen materials (i.e., cement, ceramic tiles) resulting in a negligible risk associated with radioactive constituents in building materials. Therefore the total dose and risk is equivalent to the incremental dose and risk. To estimate the incremental dose and risk from impacted buildings the ROCs are assumed to be at the respective release limit listed in Table A.4-1. Cases were run to estimate the dose and risk. Buildings with identical ROCs were combined into a single run. Multiple runs were not necessary to identify the critical exposure scenario (i.e., the scenario that presents the greatest risk). The reason for this is that occupancy time is the primary driver for the calculated risk: as occupancy time increases, so does the associated risk. Therefore, the resident scenario is the critical scenario providing the greatest risk estimate. The RESRAD-BUILD results are presented in Table A.5-1.

The combined total and incremental risk (e.g., both chemical and radiological) was derived by reviewing the TMSRA and locating grid points in close proximity to the impacted buildings. The risk for the impacted buildings estimated from RESRAD-BUILD and the TMSRA are presented in Table A.5-2.

5.2 RESRAD

The computer code used to model the chemical risk has a different set of user input parameters than RESRAD. Section 2.1 and its subsections above give some indication of the differences. The differences cause considerable difficulty in doing a direct matching calculation. Due to the inherent differences between the input parameters used for the TMSRA risk assessment and the RESRAD input parameters, the default RESRAD parameters were used when estimating risk associated with residual radioactivity at Parcel B radiologically-impacted land areas. The only exception was the size for the area of contamination. For land areas smaller than 1,000 m^2 the actual size of the land area was used. For land areas larger than 1,000 m^2 the area of contamination was assumed to be 1,000 m^2.

To estimate the total risk from radiologically-impacted soil sites the background concentrations of the ROCs other than ^{226}Ra were assumed to be essentially zero (e.g. zero pCi/g). The ^{226}Ra background concentration is assumed to be the measured background level of 0.5 pCi/g. The ROCs are assumed to be present at equivalent fractions of the respective remediation goals listed in Table A.4-1 such that the sum of the fractions does not exceed one (i.e. unity rule). Table A.5-3 presents the total dose and risk from the impacted soil site, estimated using RESRAD.

To estimate the incremental risk from impacted soil sites, the ROCs are assumed to be present at equivalent fractions of the respective remediation goals listed in Table A.4-1 such that the sum of the fractions does not exceed one (i.e. unity rule). The total incremental risk was derived by reviewing the TMSRA and locating grid points in close proximity to the impacted soil sites and adding it to the estimated risk from the ROCs. The incremental dose and risk for the impacted soil sites estimated from RESRAD are presented in Table A.5-3.

The combined total and incremental risk (e.g., both chemical and radiological) was derived by reviewing the TMSRA and locating grid points in close proximity to the impacted soil sites. The risk for the impacted buildings estimated from RESRAD and the TMSRA are presented in Table A.5-4.

In addition to site specific dose and risk assessment, several supporting studies were performed as part of this analysis. The supporting studies included a critical exposure scenario evaluation, critical pathway evaluation, cover depth study and a contamination area study. The results of these studies are documented in the following subsections.

5.2.1 Critical Exposure Scenario Evaluation

An evaluation was performed to identify the critical exposure scenario based on the exposure scenarios identified in Section 3.3 (resident, industrial worker, recreational user, and construction worker). A secondary study was performed on the receptor scenario results to evaluate what percentage each ROC contributed to the total risk. A baseline case using the RESRAD

parameters listed in Table A.2-1 was run for each exposure scenario. All other parameters were set at the default RESRAD parameters and the ROCs at the values listed in Table A.4-1.

The modeling results indicated that the resident exposure scenario is the critical exposure scenario. The results are provided in Table A.5-5.

The modeling results indicated that ^{226}Ra had the greatest contribution to the total risk of all the radionuclides evaluated. ^{226}Ra contributed between 94 to 97 percent of the total risk. These results are shown in Table A.5-6.

5.2.2 Critical Pathway Evaluation and Contamination Area Study

An evaluation was performed to identify the critical exposure pathway based on the pathways identified in Section 3.4 (external radiation, soil ingestion, inhalation, and drinking water). A baseline case using default RESRAD parameters and the ROCs at the values listed in Table A.4-1 was modeled to determine the risk contribution for each pathway. Additional cases were modeled using the TMSRA exposure areas for residential and nonresidential exposures (e.g., 232 square meters [m^2] and 2,032 m^2).

The modeling results indicated that the drinking water pathway did not contribute to the risk at the maximum risk value (exposure period equal to year zero). The drinking water pathway is the main risk contributor at the 1,000-year exposure period. However, the total risk at the 1,000-year exposure period is less that the total risk at the exposure period equal to year zero. The results are provided in Table A.5-7 and show that the external radiation pathway is the critical pathway.

5.2.3 Cover Depth

Since the external radiation pathway is the critical pathway an analysis of the cover depth was performed. The cover depth is the thickness of non-impacted material (e.g., soil, asphalt) that is placed over the impacted soil area. The RESRAD default cover depth is zero, meaning that the receptor is directly exposed to the impacted soil. As the cover depth increases the resulting risk to the receptor is reduced. For the purpose of this analysis the cover depth was modeled at thicknesses of zero inches, 4 inches, 12 inches, and 24 inches. Additionally, the RESRAD default cover erosion rate was set to zero (e.g., cover depth maintained) to account for the institutional controls proposed in the TMSRA.

The modeling results are presented in Table A.5-8 and show that at a cover depth of 1 foot the only pathway that contributes to the total risk is the external radiation pathway and that the risk is reduced to the 10^{-6} level.

The modeling output reports are provided in Attachment 1.

6.0 UNCERTAINTY ANALYSIS

Any comprehensive risk analysis must also consider the effects of uncertainty on input parameters. This analysis is no different; however, rather than perform explicit uncertainty analyses, which would have required countless additional RESRAD runs, an approach was taken that minimized the need for additional modeling computations. NRC Regulation NUREG-6697 (DoD et al., 2000) was used as the basis for the uncertainty analysis.

One of the primary purposes of NUREG-6697 was to study the effect of various parameter distributions on the final results of RESRAD analyses. As part of the NUREG study, multiple RESRAD runs were conducted for selected isotopes while varying a single parameter.

Since the isotopes included in the NUREG-6697 study cover the majority of the ROCs at Hunters Point Shipyard (HPS), it was determined that the conclusions of the NUREG-6697 study could be used as the basis for the uncertainty analysis for the modeling done as part of the TMSRA Addendum. The uncertainty considerations for each ROC are discussed separately below.

Strontium-90

The most critical parameter affecting dose and subsequent risk from ^{90}Sr used in these analyses is the contaminated zone thickness. No other parameters used in this analysis had the potential to have any substantial impact on the results. As previously mentioned, the contaminated zone was dependent on the particular scenario being modeled. In all cases, however, the thickness was selected to be very conservative, and it is fully expected that the results presented in this analysis bound the actual case. It is therefore concluded that the conservatism built into this analysis eliminates the need to run additional uncertainty cases for ^{90}Sr.

Cesium-137

Dose and subsequent risk due to ^{137}Cs is primarily due to the external radiation pathway. The density and thickness of the cover material are the key parameters used in the RESRAD analysis that affect the risk associated with ^{137}Cs. Changes to the external gamma shielding factor also can affect the results to a lesser extent.

The RESRAD default cover material density was used for all analyses performed. The default was designed to be representative of the body of soil types. In some cases, an asphalt cover was modeled with the same default soil density. In reality, asphalt would have a greater density than the default soil value. The specific density is dependent upon the asphalt-laying process. By underestimating the density of asphalt, a certain measure of conservatism has been built into the results presented in this document. It is therefore reasonable to assume that any uncertainty

associated with the cover material density is minimal and a full uncertainty analysis for a range of cover material densities is not necessary.

The selected cover thicknesses were selected based upon information in the Parcel B TMSRA (SulTech, 2006) and are consistent with average modern practices for site preparation. No additional runs are required to evaluate the uncertainty with this parameter.

The external gamma-shielding factor is a measure of how much shielding is offered by the building structures for a site receptor. This analysis used the RESRAD default value. This value was selected to be conservative for low- to medium-energy gamma emitters outside of well-shielded buildings. Since no buildings exist at any of the analyzed sites, it is reasonable to assume that any buildings on site will be constructed to modern standards and thus classify as adequately shielded. No explicit uncertainty analysis was performed for this parameter.

Radium-226

^{226}Ra is another nuclide with the majority of dose (for this analysis) resulting from the external radiation pathway. ^{226}Ra has a relatively long half-life of 1,600 years. Due to its longevity, the most important parameters affecting dose from ^{226}Ra in order from highest to lowest are thickness and density of the contaminated zone.

As noted for ^{90}Sr, the contaminated zone thickness has conservatism built in and thus does not require further uncertainty analysis. The density of the contaminated zone was modeled as the RESRAD default. All RESRAD default values are selected to provide conservative but reasonable estimates to a wider range of analyses. There is no added benefit to conducting more detailed uncertainty calculations for the ^{226}Ra dose-based risk with varying contaminated zone densities.

Plutonium-239

^{239}Pu with a 24,000-year half-life has the contaminated zone thickness as the most influential parameter for ^{239}Pu dose in these analyses. The variability in results due to changes in this parameter is far greater than any other parameters. Since the previous discussions have established that the contaminated zone thickness has substantial conservatism included in it, there is no need to perform additional uncertainty calculations.

7.0 REFERENCES

Atomic Energy Commission. 1974. *Regulatory Guide 1.86.* Termination of Operating Licenses for Nuclear Reactors. June.

Department of Defense (DoD), Department of Energy, Nuclear Regulatory Commission (NRC), and U.S. Environmental Protection Agency (EPA). 2000. *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM). NUREG-1575.

Naval Sea Systems Command (NAVSEA), 2004. *Hunters Point Shipyard Final Radiological Historical Assessment.* Vol. II.

Nuclear Regulatory Commission (NRC). 2000. *Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes.* NUREG/CR-6697. Office of Nuclear Regulatory Research Radiation Protection, Environmental Risk and Waste Management Branch.

San Francisco Redevelopment Agency. 1997. *Hunters Point Shipyard Redevelopment Plan.* July 14.

SulTech. 2006. Parcel B *Technical Memorandum in Support of a Record of Decision Amendment.* San Diego: SulTech. March 28.

TABLES

TABLE A.2-1

MODIFIED RESRAD INPUT PARAMETERS FOR CRITICAL EXPOSURE SCENARIO EVALUATION

	RESRAD	Resident		Recreational		Industrial	Construction
	Default	**Adult**	**Child**	**Adult**	**Child**	**Worker**	**Worker**
Exposure duration (yr)	30	24	6	24	6	25	1
Exposure frequency (day/yr)	IF:0.5	IF:0	IF:0	IF:0	IF:0	IF:0	IF:0
Exposure time (hr/day)	OF:0.25	OF:0.959	OF:0.959	OF:0.0713	OF:0.0713	OF:0.2283	OF:0.2283
Inhalation rate (m^3/yr)	8400	7270	3679	7276	3682	20000	20000
Soil ingestion rate (g/yr)	36.5	36.5	73.0	5.85	11.7	18.25	120.5

Abbreviations and Acronyms:

day/yr – days per year
g/yr – grams per year
hr/day – hours per day
IF – indoor fraction
m^3/yr – cubic meters per year
OF – outdoor fraction
yr – year

TABLE A.3-1

SITES AND SELECTED PARAMETERS FOR PARCEL B RADIOLOGICAL TMSRA ANALYSIS

Site or Area	Planned Reuse[c]	Reuse Scenario	Cover Details
Building 142 Site	Open Space	Educational/Cultural	Asphalt, 4 inches
Building 157	Mixed Use	Residential	Asphalt, 4 inches
IR-07[a]	Research and Development Open Space	Residential	Asphalt, 4 inches Soil, 24 inches
IR-18[b]	Research and Development Mixed Use	Residential	Asphalt, 4 inches

Notes:

[a] Two runs were conducted for this site since the site was to be split into different end use portions.
[b] Two runs were not necessary for this site since input parameters are same for the different end uses.
[c] Planned reuse from San Francisco Redevelopment Agency (1997).

Abbreviations and Acronyms:

IR – Installation Restoration
TMSRA – Technical Memorandum in Support of a Record of Decision Agreement

TABLE A.4-1

REMEDIATION GOALS

Radionuclide	Surfaces (dpm/100 cm^2)		Soil[c] (pCi/g)	
	Equipment, Waste[a]	Structures[b]	Outdoor Worker	Residential
Cesium-137	5,000	5,000	0.113	0.113
Cobalt-60	5,000	5,000	0.0602	0.0361
Plutonium-239	100	100	14.0	2.59
Radium-226	100	100	1.0[d]	1.0
Strontium-90	1,000	1,000	10.8	0.331

Notes:

[a] These limits are based on AEC *Regulatory Guide 1.86* (1974). Limits for removable surface activity are 20 percent of these values.

[b] These limits are based on 25 mrem/y.

[c] EPA PRGs.

[d] Limit is 1 pCi/g above background, per agreement with EPA.

Abbreviations and Acronyms:

AEC – Atomic Energy Commission
cm^2 – square centimeter
dpm – disintegration per minute
EPA – U.S. Environmental Protection Agency
mrem/y – millirem per year
pCi/g – picocurie per gram
PRG – Preliminary Remediation Goal

TABLE A.5-1

RESRAD-BUILD RESULTS[a]

Parcel B Impacted Sites	Radiological Risk[b]	Dose[c]
Building 103	1.48×10^{-6}	7.02
Building 113	1.48×10^{-6}	7.02
Building 113A	1.60×10^{-6}	1.45
Building 130	1.60×10^{-6}	1.45
Building 140	1.44×10^{-6}	5.43
Building 146	1.16×10^{-6}	1.20

Notes:

[a] Total risk and dose is equivalent to incremental risk and dose
[b] Total excess lifetime carcinogen risk
[c] mrem/yr – millirem per year

TABLE A.5-2

COMBINED RISK FOR RADIOLOGICALLY-IMPACTED BUILDINGS

Combined Total Risk			
Parcel B Impacted Sites	Radiological Risk[a]	Chemical Risk[b]	Combined Risk
Building 103	1.48×10^{-6}	Not Evaluated	1.48×10^{-6}
Building 113	1.48×10^{-6}	2.00×10^{-4}	2.01×10^{-4}
Building 113A	1.60×10^{-6}	2.00×10^{-4}	2.01×10^{-4}
Building 130	1.60×10^{-6}	3.00×10^{-4}	3.01×10^{-4}
Building 140	1.44×10^{-6}	1.00×10^{-4}	1.01×10^{-4}
Building 146	1.16×10^{-6}	1.00×10^{-4}	1.01×10^{-4}
Combined Incremental Risk			
Parcel B Impacted Sites	**Radiological Risk[a]**	**Chemical Risk[b]**	**Combined Risk**
Building 103	1.48×10^{-6}	Not Evaluated	1.48×10^{-6}
Building 113	1.48×10^{-6}	7.00×10^{-9}	1.48×10^{-6}
Building 113A	1.60×10^{-6}	7.00×10^{-9}	1.60×10^{-6}
Building 130	1.60×10^{-6}	8.00×10^{-6}	9.60×10^{-6}
Building 140	1.44×10^{-6}	1.00×10^{-4}	1.01×10^{-4}
Building 146	1.16×10^{-6}	7.00×10^{-6}	8.16×10^{-6}

Notes:

[a] Total excess lifetime carcinogen risk
[b] Chemical risk was taken from TMSRA Tables A-15, A-16, A-19, and A-20

Abbreviations and Acronyms:

TMSRA – Technical Memorandum in Support of a Record of Decision Agreement

TABLE A.5-3

RESRAD RESULTS

Total Dose and Risk		
Impacted Soil Areas	**Radiological Risk[a]**	**Dose[b]**
Building 142 Site	6.39×10^{-5}	3.48
Building 157 Site	8.90×10^{-5}	4.86
IR-07	4.51×10^{-5}	3.27
IR-18	4.51×10^{-5}	3.27
Incremental Dose and Risk		
Impacted Soil Areas	**Radiological Risk[a]**	**Dose[b]**
Building 142 Site	4.35×10^{-5}	2.39
Building 157 Site	5.97×10^{-5}	3.25
IR-07	3.02×10^{-5}	2.26
IR-18	3.02×10^{-5}	2.26

Notes:

[a] Total excess lifetime carcinogen risk

[b] millirem per year

Abbreviations and Acronyms:

IR – Installation Restoration

TABLE A.5-4

COMBINED RISK FOR RADIOLOGICALLY-IMPACTED SOIL SITES

Combined Total Risk			
Parcel B Impacted Sites	**Radiological Risk[a]**	**Chemical Risk[b]**	**Combined Risk**
Building 142 Site	6.39×10^{-5}	1.00×10^{-4}	1.64×10^{-4}
Building 157 Site	8.90×10^{-5}	2.00×10^{-4}	2.89×10^{-4}
IR-07	4.51×10^{-5}	2.00×10^{-4}	2.45×10^{-4}
IR-18	4.51×10^{-5}	1.00×10^{-4}	1.45×10^{-4}
Combined Incremental Risk			
Parcel B Impacted Sites	**Radiological Risk[a]**	**Chemical Risk[b]**	**Combined Risk**
Building 142 Site	4.35×10^{-5}	1.00×10^{-4}	1.44×10^{-4}
Building 157 Site	5.97×10^{-5}	4.00×10^{-5}	9.97×10^{-5}
IR-07	3.02×10^{-5}	3.00×10^{-3}	3.03×10^{-3}
IR-18	3.02×10^{-5}	9.00×10^{-6}	3.92×10^{-5}

Notes:

[a] Total excess lifetime carcinogen risk
[b] Chemical risk was taken from TMSRA Tables A-15, A-16, A-19, and A-20

Abbreviations and Acronyms:

IR – Installation Restoration
TMSRA – Technical Memorandum in Support of a Record of Decision Agreement

TABLE A.5-5

CRITICAL EXPOSURE SCENARIO EVALUATION RESULTS

	Total Risk	Pathway Fraction of Total Risk			
	(excess cancer)	External	Inhalation	Ingestion	Drinking Water
Resident (Adult)	2.77E-04	0.9898	0.002	0.0082	0
Resident (Child)	7.23E-05	0.9892	0.0009	0.0099	0
Industrial Worker	6.86E-05	0.9903	0.0056	0.0042	0
Recreational (Adult)	2.05E-05	0.9967	0.002	0.0013	0
Recreational (Child)	5.33E-06	0.9975	0.0009	0.0016	0
Construction Worker	2.93E-06	0.9826	0.0049	0.0125	0

TABLE A.5-6

CRITICAL ISOTOPE EVALUATION RESULTS

	Total Risk	Radionuclide Fraction of Total Risk				
	(excess cancer)	Cobalt-60	Cesium-137	Plutonium-239	Radium-226	Strontium-90
Resident (Adult)	2.77×10^{-4}	0.011	0.017	0.003	0.969	0.0004
Resident (Child)	7.23×10^{-5}	0.0232	0.02	0.0034	0.9528	0.0006
Industrial Worker	6.86×10^{-5}	0.0103	0.017	0.0047	0.9676	0.0004
Recreational (Adult)	2.05×10^{-5}	0.0107	0.0173	0.0017	0.9699	0.0005
Recreational (Child)	5.33×10^{-6}	0.0234	0.0202	0.0012	0.9548	0.0008
Construction Worker	2.93×10^{-6}	0.0307	0.0208	0.098	0.9397	0.001

TABLE A.5-7

CRITICAL PATHWAY EVALUATION RESULTS

	Total Risk	Pathway Fraction of Total Risk			
	(excess cancer)	External	Inhalation	Ingestion	Water
RESRAD Baseline	2.15E-04	0.987	0.0018	0.0112	0
TMSRA 232 m^2	1.91E-04	0.9957	0.0013	0.0029	0
TMSRA 2,032 m^2	2.07E-04	0.9868	0.0016	0.0117	0

Abbreviations and Acronyms:

m^2 – square meter
RESRAD – Residual Radioactivity (Model)
TMSRA – Technical Memorandum in Support of a Record of Decision Agreement

TABLE A.5-8

COVER DEPTH AND CONTAMINATION AREA EVALUATION RESULTS

	Total Risk	Pathway Fraction of Total Risk			
	(excess cancer)	External	Inhalation	Ingestion	Drinking Water
0 inch Cover Material					
RESRAD Baseline	2.15E-04	0.987	0.0018	0.0112	0
TMSRA 232 m^2	1.91E-04	0.9957	0.0013	0.0029	0
TMSRA 2032 m^2	2.07E-04	0.9868	0.0016	0.0117	0
4 inch Cover Material					
RESRAD Baseline	6.31E-05	0.9857	0.002	0.0124	0
TMSRA 232 m^2	6.24E-05	0.9958	0.0013	0.0029	0
TMSRA 2032 m^2	6.31E-05	0.986	0.0017	0.0124	0
12 inch Cover Material					
RESRAD Baseline	5.98E-06	1	0	0	0
TMSRA 232 m^2	5.98E-06	1	0	0	0
TMSRA 2032 m^2	5.98E-06	1	0	0	0
24 inch Cover Material					
RESRAD Baseline	1.89E-07	1	0	0	0
TMSRA 232 m^2	1.89E-07	1	0	0	0
TMSRA 2032 m^2	1.89E-07	1	0	0	0

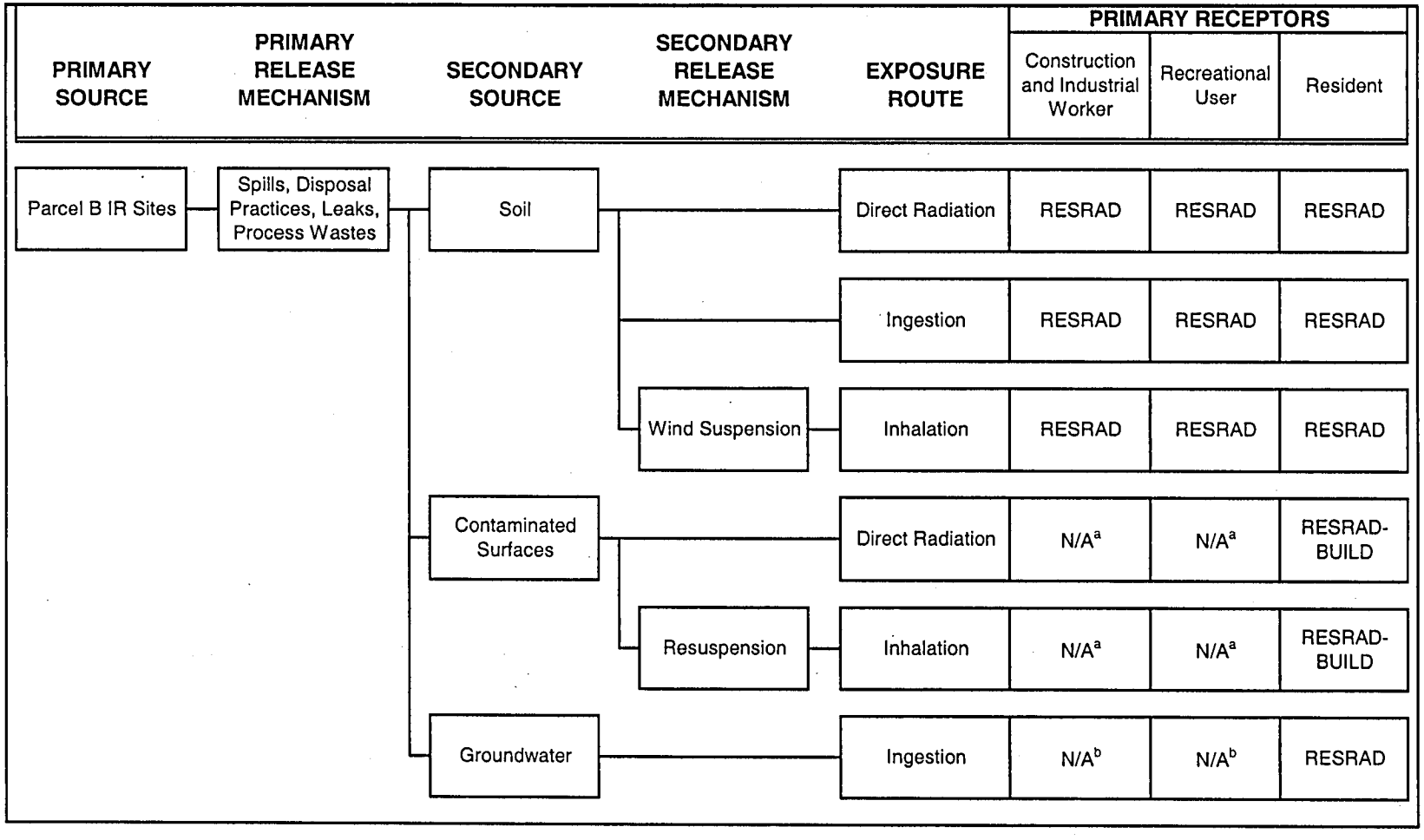
Abbreviations and Acronyms:

m^2 – square meter
RESRAD – Residual Radioactivity (Model)
TMSRA – Technical Memorandum in Support of a Record of Decision Agreement

FIGURES

FIGURE A.3-1

CONCEPTUAL SITE MODEL



Notes:

[a] Resident scenario bounds the worker and recreational user scenarios.

[b] Groundwater pathway only analyzed for resident scenario.

Abbreviations and Acronyms:

IR – Installation Restoration

N/A – not applicable

ATTACHMENT 1

RESRAD MODELING

~~(PROVIDED ON CD)~~

ATTACHMENT 1 – RESRAD MODELING

RAW ANALYTICAL DATA IS NOT REQUIRED TO BE LOCATED AT OR NEAR THE INSTALLATION AND INFORMATION REPOSITORY.

FOR ADDITIONAL INFORMATION, CONTACT:

DIANE C. SILVA, RECORDS MANAGER
NAVAL FACILITIES ENGINEERING COMMAND, SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676
E-MAIL: diane.silva@navy.mil

APPENDIX B

REMEDIAL ACTION ALTERNATIVE COST SUMMARY SHEETS

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

CONTRACT NO. N62473-06-D-2201
CTO NO. 0006

APPENDIX B

FINAL

REMEDIAL ACTION ALTERNATIVE COST SUMMARY SHEETS March 14, 2008

PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

DCN: ECSD-2201-0006-0074

TETRA TECH EC, INC.
1230 Columbia Street, Suite 750
San Diego, CA 92101-8536

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cy	cubic yard
EPA	Environmental Protection Agency
FS	Feasibility Study
ft^2	square feet
ft^3	cubic feet
HPS	Hunters Point Shipyard
IC	institutional control
IR	Installation Restoration
m^2	square meter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
O&M	operations and maintenance
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment

1.0 INTRODUCTION

This appendix describes each alternative and the associated components and assumptions used to develop the cost estimate for the Radiological Addendum to the Parcel B Technical Memorandum in Support of a Record of Decision Amendment (TMSRA) for Hunters Point Shipyard (HPS) in San Francisco, California. This appendix is organized as follows:

- Section 2.0 describes the purpose of the estimate.
- Section 3.0 presents the types of cost-estimating methods used.
- Section 4.0 summarizes the cost-estimating methodology.
- Section 5.0 describes the components of each alternative's cost estimate.
- Section 6.0 provides assumptions used for each cost estimate.
- Section 7.0 summarizes the total costs for each alterative.
- Section 8.0 lists references used in preparing the cost estimate.

2.0 PURPOSE OF ESTIMATE

The cost estimates developed for this Radiological Addendum to the Parcel B TMSRA follow the same general guidelines as for feasibility studies (FS). Cost estimates are developed for FSs primarily to compare remedial alternatives during the remedy selection process, and not to establish project budgets or to negotiate Superfund enforcement settlements. The cost estimate in the Record of Decision reflects any changes to the remedial alternative that occur during the remedy selection process as a result of new information or public comments (U.S. Environmental Protection Agency [EPA], 2000).

Cost estimates developed during the detailed analysis phase of a FS are used to compare alternatives and to support remedy selection. The National Oil and Hazardous Substances Pollution Contingency Plan includes the following language in its description of the cost criterion for the detailed analysis and remedy selection.

"The types of costs that shall be assessed include the following: (1) capital costs, including both direct and indirect costs; (2) annual operations and maintenance (O&M) costs; and (3) net present values of capital and O&M costs" (Title 40 Code of Federal Regulations Part 300.430 [e][9][iii][G]) (EPA, 2000).

The costs presented in this appendix are for comparison only; the estimated accuracy is within the expected accuracy range of cost estimates (e.g. -30 to +50 percent), in accordance with the guidelines for developing and documenting cost estimates for FS under the Comprehensive Environmental Response, Compensation, and Liability Act (EPA, 2000).

3.0 TYPES OF COST-ESTIMATING METHODS

The cost estimates presented in this appendix are derived from the cost estimates presented in Appendix D of the Parcel B TMSRA (SulTech, 2006). The Parcel B TMSRA costs were developed using both detailed and parametric approaches; both are accepted by EPA. These approaches are described below.

The detailed approach estimates cost on an item-by-item basis. Detailed methods typically rely on compiled sources of unit cost data for each item, taken from either a built-in database or from other sources. This method, also known as "bottom up" estimating, is used when design information is available (EPA, 2000).

The parametric approach relies on relationships between cost and design parameters. These relationships are usually either statistical or model-based. Statistically based approaches rely on scaled-up or scaled-down versions of projects where historical data on costs are available. Model-based approaches use a generic design linked to a cost database and adjusted for site-specific information. This method, also known as "top down" estimating, is used when design information is not available (EPA, 2000).

4.0 METHODOLOGY

Cost estimates for this Radiological Addendum to the Parcel B TMSRA were prepared in accordance with *A Guide to Developing and Documenting Cost Estimates During Feasibility Study* (EPA, 2000). For the most part, the costs were derived directly from Appendix D of the Parcel B TMSRA (SulTech, 2006). Costs associated with activities not addressed by the Parcel B TMSRA were estimated based on past experience with similar activities.

5.0 COMPONENTS OF COST ESTIMATE

The cost estimates for the remediation alternatives presented in the TMSRA included seven components: grand total, total capital costs, total direct costs, annual O&M costs, net present value of O&M costs, and contingency costs.

The cost estimates provided in this Radiological Addendum to the Parcel B TMSRA are based on the total cost inclusive of overhead and profit presented in Appendix D of the Parcel B TMSRA (SulTech, 2006). The main assumption is that activities common to both the Parcel B TMSRA and this addendum will be addressed by the cost estimate provided in Appendix D of the Parcel B TMSRA. For example, the costs associated with the Legal Controls (i.e., land-use controls, land transfer, and covenant to restrict use) are applicable to both chemical and radiological alternatives. The expectation is that one set of legal controls will address both chemical and radiological concerns. The cost estimates for these types of activities will not be added to the radiological alternative's cost estimate.

There are other common activities where the Parcel B TMSRA unit cost of the activity is used to estimate the total cost of the activity in this addendum. One example is costs associated with excavation of soil. The Parcel B TMSRA (SulTech, 2006) provides a cost for excavating 3,704 cubic yards (cy) of soil requiring radiological screening. The total excavation cost was divided by 3,704 cy to get a cost per cy. This unit cost was used to estimate the excavation costs for the alternatives proposed by this addendum.

6.0 INDIVIDUAL COST ESTIMATE ASSUMPTIONS

This section identifies the assumptions and parameters used in developing cost estimates in support of this Radiological Addendum to the Parcel B TMSRA

General assumptions taken from Appendix D of the Parcel B TMSRA for each cost estimate are summarized for each alternative that involves remediation of radionuclides of concern. The cost estimate components and specific assumption are presented for each alternative below. The cost presented in the following sections is raw cost and does not include costs associated with field oversight, project management, general administrative services, overhead, and fee.

6.1 COST ASSUMPTION ASSOCIATED WITH ALTERNATIVE S-2: INSTITUTIONAL CONTROLS, MAINTAINED LANDSCAPING, AND SHORELINE REVETMENT

In addition to the Parcel B TMSRA (SulTech, 2006) Alternative S-2 remedial actions, this radiological remedy proposes to provide radiological screening in support of the shoreline revetment identified in the TMSRA Alternative S-2 (SulTech, 2006). The cost for screening of soils is already included in the proposal in the Parcel B TMSRA. Alternative S-2 includes no additional remediation for the radionuclides of concern above the remediation goals.

The following assumptions apply to Alternative S-2.

1. The entire Parcel B would have institutional controls established and those costs are already shown in the Parcel B TMSRA (SulTech, 2006).
2. The TMSRA did not assume that there would be a radiological survey during the shoreline revetment. A total of 14,520 square yards of shoreline is assumed to need preparation to receive the revetment (SulTech, 2006), hence a radiological survey. It is assumed that one foot of soil will need to be removed and screened for a total of 537 cy. The cost of screening soil is $65 per cy. The radiological survey of the shoreline revetment soil is assumed to cost $34,900.
3. A radiologically-impacted soil/material cost of $11,880 per disposal bin, based on a 14-cy disposal bin, is used to determine the radiological disposal cost for the 27 cy of soil (assuming that 5 percent of the soil screened is determined to be radiologically-impacted) as resulting in a cost of $23,760.

The table below provides a breakdown of the estimated cost for Alternative S-2.

Radiological screening survey in support of Shoreline Revetment	$	34,900
Disposal of soil identified during screening survey	$	23,760
20 percent Contingency	$	11,730
***Total Estimated Additional Cost for Alternative S-2**	**$**	**70,000**

Notes:

* Total estimated cost has been rounded to the nearest thousand.

6.2 COST ASSUMPTION ASSOCIATED WITH ALTERATIVE S-3: EXCAVATION, METHANE AND MERCURY SOURCE REMOVAL, DISPOSAL, MAINTAINED LANDSCAPING, INSTITUTIONAL CONTROLS, AND SHORELINE REVETMENT

In addition to the TMSRA (SulTech, 2006) Alternative S-3 remedial actions (methane and mercury source removal and shoreline revetment), this radiological remedy proposes to include radiological support of the methane source removal and shoreline revetment and dispose of any radionuclides of concern found above the Table 3-2 levels in a licensed off-site facility.

The following assumptions apply to Alternative S-3:

1. The disposal cost for radiological wastes is assumed to be approximately $849 per cy contained (SulTech, 2006). The Parcel B TMSRA assumes that an area of 50 feet by 100 feet and a depth of 20 feet will be excavated, approximately 3,700 cy (SulTech, 2006). It is assumed that 5 percent of the soil generated during the methane removal will be radiologically-impacted resulting in 185 cy and an associated disposal cost of $157,065. The cost of radiologically screening is estimated to be $65 per cy resulting in a cost of $240,500.
2. The TMSRA did not assume that there would be a radiological survey during the shoreline revetment. A total of 14,520 square yards of shoreline is assumed to need preparation to receive the revetment (SulTech, 2006), hence a radiological survey. It is assumed that one foot of soil will need to be removed and screened for a total of 537 cy. The cost of screening soil is $65 per cy. The radiological survey of the shoreline revetment soil is assumed to cost $34,900.
3. A radiologically-impacted soil/material cost of $11,880 per disposal bin, based on a 14-cy disposal bin, is used to determine the radiological disposal cost for the 27 cy of soil (assuming that 5 percent of the soil screened is determined to be radiologically-impacted) as resulting in a cost of $23,760.
4. The entire Parcel B would have ICs established and those costs are already shown in the Parcel B TMSRA (SulTech, 2006).

The table below provides a breakdown of the estimated cost for Alternative S-3.

Radiological screening survey in support of Shoreline Revetment	$ 34,900
Disposal of soil identified during Shoreline Revetment screening survey	$ 23,760
Radiological screening survey in support of Methane Source Removal	$ 240,500
Disposal of soil identified during Methane Removal screening survey	$ 157,065
20% Contingency	$ 91,245
***Total Estimated Additional Cost for Alternative S-3**	**$ 547,000**

Notes:

* Total estimated cost has been rounded to the nearest thousand.

6.3 COST ASSUMPTION ASSOCIATED WITH ALTERATIVE S-4: COVERS, METHANE AND MERCURY SOURCE REMOVAL, DISPOSAL, INSTITUTIONAL CONTROLS, AND SHORELINE REVETMENT

In addition to the TMSRA (SulTech, 2006) Alternative S-4 remedial actions (methane and mercury source removal, shoreline revetment, and covering of all redevelopment blocks), this radiological remedy proposes to provide radiological support of the methane source removal and shoreline revetment and dispose of any radionuclides of concern found above the Table 3-2 levels in a licensed off-site facility.

The following assumptions apply to Alternative S-4:

1. The disposal cost for radiological wastes is assumed to be approximately $849 per cy contained (SulTech, 2006). The Parcel B TMSRA assumes that an area of 50 feet by 100 feet and a depth of 20 feet will be excavated, approximately 3,700 cy (SulTech, 2006). It is assumed that 5 percent of the soil generated during the methane removal will be radiologically-impacted resulting in 185 cy and an associated disposal cost of $157,065. The cost of radiologically screening is estimated to be $65 per cy resulting in a cost of $240,500.
2. The TMSRA did not assume that there would be a radiological survey during the shoreline revetment. A total of 14,520 square yards of shoreline is assumed to need preparation to receive the revetment (SulTech, 2006), hence a radiological survey. It is assumed that one foot of soil will need to be removed and screened for a total of 537 cy. The cost of screening soil is $65 per cy. The radiological survey of the shoreline revetment soil is assumed to cost $34,900.
3. A radiologically-impacted soil/material cost of $11,880 per disposal bin, based on a 14-cy disposal bin, is used to determine the radiological disposal cost for the 27 cy of soil (assuming that 5 percent of the soil screened is determined to be radiologically-impacted) as resulting in a cost of $23,760.
4. The entire Parcel B would have institutional controls (ICs) established and those costs are already shown in the Parcel B TMSRA (SulTech, 2006).

The table below provides a breakdown of the estimated cost for Alternative S-4.

Radiological screening survey in support of Shoreline Revetment	$	34,900
Disposal of soil identified during Shoreline Revetment screening survey	$	23,760
Radiological screening survey in support of Methane Source Removal	$	240,500
Disposal of soil identified during Methane Removal screening survey	$	157,065
20% Contingency	$	91,245
***Total Estimated Additional Cost for Alternative S-4**	**$**	**547,000**

Notes:

* Total estimated cost has been rounded to the nearest thousand.

6.4 COST ASSUMPTION ASSOCIATED WITH ALTERNATIVE S-5: EXCAVATION, METHANE AND MERCURY SOURCE REMOVAL, DISPOSAL, COVERS, SOIL VAPOR EXTRACTION, INSTITUTIONAL CONTROLS, AND SHORELINE REVETMENT

In addition to the TMSRA (SulTech, 2006) Alternative S-5 remedial actions (methane and mercury source removal, covers, soil vapor extraction, ICs, and shoreline revetment), this radiological remedy proposes to provide radiological support of the methane source removal and shoreline revetment and dispose of any radionuclides of concern found above the Table 3-2 levels in a licensed off-site facility.

The following assumptions apply to Alternative S-5:

1. The disposal cost for radiological wastes is assumed to be approximately $849 per cy contained (SulTech, 2006). The Parcel B TMSRA assumes that an area of 50 feet by 100 feet and a depth of 20 feet will be excavated, approximately 3,700 cy (SulTech, 2006). It is assumed that 5 percent of the soil generated during the methane removal will be radiologically-impacted resulting in 185 cy and an associated disposal cost of $157,065. The cost of radiologically screening is estimated to be $65 per cy resulting in a cost of $240,500.
2. The TMSRA did not assume that there would be a radiological survey during the shoreline revetment. A total of 14,520 square yards of shoreline is assumed to need preparation to receive the revetment (SulTech, 2006), hence a radiological survey. It is assumed that one foot of soil will need to be removed and screened for a total of 537 cy. The cost of screening soil is $65 per cy. The radiological survey of the shoreline revetment soil is assumed to cost $34,900.
3. A radiologically-impacted soil/material cost of $11,880 per disposal bin, based on a 14-cy disposal bin, is used to determine the radiological disposal cost for the 27 cy of soil (assuming that 5 percent of the soil screened is determined to be radiologically-impacted) as resulting in a cost of $23,760.
4. The entire Parcel B would have ICs established and those costs are already shown in the Parcel B TMSRA (SulTech, 2006).

The table below provides a breakdown of the estimated cost for Alternative S-5.

Radiological screening survey in support of Shoreline Revetment	$	34,900
Disposal of soil identified during Shoreline Revetment screening survey	$	23,760
Radiological screening survey in support of Methane Source Removal	$	240,500
Disposal of soil identified during Methane Removal screening survey	$	157,065
20% Contingency	$	91,245
***Total Estimated Additional Cost for Alternative S-5**	**$**	**547,000**

Notes:

* Total estimated cost has been rounded to the nearest thousand.

6.5 COST ASSUMPTION ASSOCIATED WITH ALTERNTIVE GW-2: LONG-TERM MONITORING OF GROUNDWATER AND INSTITUTIONAL CONTROLS

In addition to the TMSRA (SulTech, 2006) Alternative GW-2 remedial actions, this radiological remedy proposes to sample the groundwater for radionuclides of concern.

The following assumptions apply to Alternative GW-2:

1. Groundwater monitoring includes the sampling process. Radiological samples will be collected at the same time by the same personnel.
2. Radiological analysis of groundwater is assumed to be $200 per sample.

The table below provides a breakdown of the estimated cost for Alternative GW-2.

Legal Controls	**Cost**
Land Use Control Remedial Design	$ 33,225
Finding of Suitability to Transfer	$ 21,300
Covenant to Restrict Use of Property	$ 7,500
26 wells sampled quarterly first year and annually thereafter for 30 years	$ 171,600
20% Contingency	$ 46,725
***Total Estimated Cost for Alternative GW-2**	**$ 280,000**

Notes:

* Total estimated cost has been rounded to the nearest thousand.

6.6 COST ASSUMPTION ASSOCIATED WITH ALTERNATIVE GW-3A AND GW-3B: IN SITU TREATMENT, GROUNDWATER MONITORING, AND INSTITUTIONAL CONTROLS

In addition to the TMSRA (SulTech, 2006) Alternative GW-3A and GW-3B remedial actions, this radiological remedy proposes to sample the groundwater for radionuclides of concern. Alternatives GW-3A and GW-3B have no additional remedies for radionuclides of concern.

The following assumptions apply to Alternative GW-3A and GW-3B:

1. Groundwater monitoring includes the sampling process. Radiological samples will be collected at the same time by the same personnel.
2. Radiological analysis of groundwater is assumed to be $200 per sample.

The table below provides a breakdown of the estimated cost for Alternative 3.

Legal Controls	Cost
Land Use Control Remedial Design	$ 33,225
Fining of Suitability to Transfer	$ 21,300
Covenant to Restrict Use of Property	$ 7,500
26 wells sampled quarterly first year and annually thereafter for 30 years	$ 171,600
20% Contingency	$ 46,725
***Total Estimated Cost for Alternative GW-3A/GW-3B**	**$ 280,000**

Notes:

* Total estimated cost has been rounded to the nearest thousand.

6.7 COST ASSUMPTION ASSOCIATED WITH ALTERNATIVE R-2: SURVEY, DECONTAMINATION, DISPOSAL, AND RELEASE

Alternative R-2 consists of decontamination of radiologically-impacted buildings and dismantlement if necessary. Surveys would be performed on buildings except Building 140, soils of former building sites, trenches resulting from sewer and storm line removal, and soils of remediated storm drains and sanitary sewers to meet the remedial action objectives. A surface scan of Installation Restoration (IR) Sites 07 and 18 would be performed with removal of anomalies down to one foot, backfill with clean material to grade, and use of institutional controls.

The above-grade portions of Building 140, the discharge tunnel, and the first 10 feet of the Building 140 shaft would be surveyed to verify that no residual radioactivity is present above the Remedial Action Objectives. The Building 140 Shaft below 10 feet would be abandoned as is due to the unsound condition of the building, health and safety hazards associated with field conditions, as well as many other unknowns. ICs would be implemented to minimize inadvertent contact with radiologically-impacted media.

The following assumptions apply to Alternative R-2:

1. Each building (103, 113, 113A, 130, and 146) will be divided into 31 Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (Department of Defense et al., 2000) survey units. Each former building site (142 and 157) will be divided into three survey units. The cost for developing the survey plans, performing the survey, and drafting the report is $6,500 per survey unit. This cost is based on the San Francisco "49ers" Parcel D proposal summary.
2. Each building (103, 113, 113A, 130, and 146) is assumed to generate one disposal bin of material (e.g., flooring, ventilation piping, etc.) using a disposal cost of $11,880 per bin with the total cost $59,400.
3. Each former building site (142 and 157) survey unit is assumed to have two elevated areas resulting in the generation of 10 cubic feet (ft^3) of radiologically-impacted soil from

each survey unit. The total volume of radiologically-impacted soil is estimated to be 60 ft^3 (2 cy). The cost of disposal is assumed to be $11,880 per bin, and based on 14 cy of soil per bin the total disposal cost is estimated to be $11,880.

4. Building 140 will be divided into 15 MARSSIM survey units expcept for the shaft below 10 feet. The Building 140 shafts below 10 feet will not be MARSSIM surveyed due to the unsound condition of the building, health and safety hazards, as well as many other unknowns. This portion of the building will be abandoned in-place and ICs will be implemented to minimize inadvertent contact with radiologically-impacted media. The institutional controls for Building 140 are assumed to add no additional cost to the institutional controls already proposed for Parcel B.
5. IR Sites 07 and 18 will be divided into 1,000 square meter (m^2) survey units. The surface area of the two sites is approximately 69,000 m^2 (740,000 square feet [ft^2]) resulting in 69 survey units. The cost of performing the survey in each survey unit is assumed to be $6,500. Each survey unit is assumed to have two elevated areas resulting in the generation of 10 ft^3 of radiologically-impacted soil from each survey unit. The total volume of radiologically-impacted soil is estimated to be 690 ft^3 (26 cy). The cost of disposal is assumed to be $11,880 per bin, and based on 14 cy of soil per bin the total disposal cost is estimated to be $23,760.
6. Soils of former building sites (142 and 157) amount to an area of 19,500 square feet and a depth of one foot. This equates to soil screening of approximately 722 cy of soil at $65 per cy or $46,930 for the two sites.
7. Removal of the Parcel B sewer and storm drain systems is estimated to result in 60,000 cy of material to be excavated at an estimated cost of $330 per cy of material excavated. This results in a total excavation cost of $19,800,000.
8. It is assume that 5 percent of the material excavated during the Parcel B sewer and storm drain system removal will be radiologically-impacted resulting in approximately 3,000 cy of material. The cost of disposal is assumed to be $11,880 per bin, and based on 14 cy of soil per bin the total disposal cost is estimated to be $2,542,320. Note this does not include cost associated with disposal of CERCLA-impacted materials.

The table below provides a breakdown of the estimated cost for Alternative R-2.

Impacted Parcel B Building and former building site Surveys/Release	$ 1,144,000
IR Sites 07 and 18 Soil Survey/Disposal	$ 472,260
Radiological soil screening and waste disposal for building and building sites	$ 118,210
Parcel B sewer and storm drain removal and disposal	$ 22,342,320
20% Contingency	$ 4,815,000
***Total Estimated Cost for Alternative R-2**	**$ 28,892,000**

Notes:

* Total estimated cost has been rounded to the nearest thousand.

6.8 COST ASSUMPTION ASSOCIATED WITH ALTERNATIVE R-3: SURVEY, DECONTAMINATION, DISPOSAL, RELEASE, CLOSE IN-PLACE, AND INSTITUTIONAL CONTROLS

Alternative R-3 consists of decontamination of impacted buildings, except for Building 140, dismantlement if necessary, and surveys to ensure the remedial action objectives are met. This alternative assumes that the Building 140 shaft below 10 feet would be closed in-place with backfilled stone and a concrete cap and institutional controls will be assigned. Surface scans of IR Sites 07 and 18 with removal of anomalies down to one foot, backfill with clean material to grade, and ICs would be assigned.

The following assumptions apply to Alternative R-3:

1. Each building (103, 113, 113A, 130, and 146) will be divided into 31 MARSSIM survey units. Building 140 will be divided into 15 MARSSIM survey units expect for the shaft below 10 feet. The Building 140 shaft below 10 feet will not be released. It will be closed in-place with stone and a concrete cap with ICs added. The ICs for Building 140 are assumed to add no additional cost to the ICs already proposed for Parcel B. Each former building site (142 and 157) will be divided into three survey units. The cost for developing the survey plans, performing the survey, and drafting the report is $6,500 per survey unit.
2. Each building (103, 113, 113A, 130, and 146) is assumed to generate one disposal bin of material (e.g., flooring, ventilation piping, etc.) using a disposal cost of $11,880 per bin with the total cost $59,400.
3. Each former building site (142 and 157) survey unit is assumed to have two elevated areas resulting in the generation of 10 ft^3 of radiologically-impacted soil from each survey unit. The total volume of radiologically-impacted soil is estimated to be 60 ft^3 (2 cy). The cost of disposal is assumed to be $11,880 per bin, and based on 14 cy of soil per bin the total disposal cost is estimated to be $11,880.
4. IR Sites 07 and 18 will be divided into 1,000 m^2 survey units. The surface area of the two sites is approximately 69,000 m^2 (740,000 ft^2) resulting in 69 survey units. The cost of performing the survey in each survey unit is assumed to be $6,500. Each survey unit is assumed to have two elevated areas resulting in the generation of 10 ft^3 of radiologically-impacted soil from each survey unit. The total volume of radiologically-impacted soil is estimated to be 690 ft^3 (26 cy). The cost of disposal is assumed to be $11,880 per bin, and based on 14 cy of soil per bin the total disposal cost is estimated to be $23,760.
5. Soils of former building sites (114 and 142) will be radiologically screened with an area of 19,500 square feet and a depth of one foot. This equates to soil screening of 722 cy of soil at $65 per cy or $46,930 for the two sites.
6. Building 140 will be divided into 15 MARSSIM survey units except for the shaft below 10 feet. The Building 140 estimated volume to be backfilled in place is 4,810 cy. This volume will be filled with 7,200 tons of ¾-inch minus stone (#57 in most states) and 415 cy (6-ft thickness estimated) of concrete. Modifications would have to be completed to the building to facilitate access and dumping of the materials. The discharge channel would have to be opened and the drydock inlets sealed to eliminate impacts to the bay. It

is estimated that least one month of preparation time is needed prior to the backfilling activity. The estimated costs are as follows: $32 per ton for stone, $270 per cy for concrete, and $250,000 for labor, construction management, equipment, and tool rental. These estimates result in a total estimated cost of $592,450.

7. Removal of the Parcel B sewer and storm drain systems is estimated to result in 60,000 cy of material to be excavated at an estimated cost of $330 per cy of material excavated. This results in a total excavation cost of $19,800,000.

8. It is assumed that 5 percent of the material excavated during the Parcel B sewer and storm drain system removal will be radiologically-impacted resulting in approximately 3,000 cy of material. The cost of disposal is assumed to be $11,880 per bin, and based on 14 cy of soil per bin the total disposal cost is estimated to be $2,542,320. Note this does not include cost associated with disposal of CERCLA-impacted materials.

The table below provides a breakdown of the estimated cost for Alternative R-3.

Impacted Parcel B Building Surveys/Release Except for Building 140	$ 1,144,000
Backfill of Building 140 shaft below 10 feet with stone and concrete cap	$ 592,450
IR Sites 07 and 18 Soil Survey/Disposal	$ 472,260
Radiological soil screening and waste disposal for building and building sites	$ 118,210
Parcel B sewer and storm drain removal and disposal	$ 22,342,320
20% Contingency	$ 4,934,000
***Total Estimated Cost for Alternative R-3**	**$ 29,603,000**

Notes:

* Total estimated cost has been rounded to the nearest thousand.

7.0 SUMMARY

The total cost for each alternative is summarized below.

Alternative Name and Description	Estimated Cost[a]
Alternative S-1 – No Action	$0
Alternative S-2 – Institutional Controls and Shoreline Revetment	$70,000[b]
Alternative S-3 – Excavation and Removal/Disposal	$547,000[b]
Alternative S-4 – Covers, Methane Source Removal, Institutional Controls, and Shoreline Revetment	$547,000[b]
Alternative S-5 – Excavation, Methane Source Removal, Disposal, Covers, Soil Vapor Extraction, Institutional Controls, and Shoreline Revetment	$547,000[b]
Alternative GW-1 – No Action	$0
Alternative GW-2 – Long-Term Monitoring of Groundwater and Institutional Control	$280,000[b]
Alternative GW-3A and GW-3B – In-Situ Treatment, Groundwater Monitoring, and Institutional Controls	$280,000[b]
Alternative R-1 – No Action	$0
Alternative R-2 – Survey, Decontamination, Disposal, and Release	$28,892,000
Alternative R-3 – Survey, Decontamination, Disposal, Release, and Institutional Controls	$29,603,000

Notes:

[a] Rounded to the nearest thousand dollars.
[b] Additional cost

8.0 REFERENCES

Department of Defense, Department of Energy, Nuclear Regulatory Commission (NRC), and U.S. Environmental Protection Agency (EPA). 2000. *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM). NUREG-1575.

Environmental Protection Agency (EPA). 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*. 540-R-00-002 OSWER 9355.0-75.

SulTech. 2006. Parcel B *Technical Memorandum in Support of a Record of Decision Amendment*. SulTech: 1230 Columbia Street, Suite 1000, San Diego, CA. March 28.

APPENDIX C

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

CONTRACT NO. N62473-06-D-2201
CTO NO. 0006

APPENDIX C

FINAL

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

March 14, 2008

PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

DCN: ECSD-2201-0006-0074

TETRA TECH EC, INC.
1230 Columbia Street, Suite 750
San Diego, CA 92101-8536

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

§	Section
AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
cm	centimeter
DERP	Defense Environmental Restoration Program
DOE	Department of Energy
DON	Department of Navy
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
HPS	Hunters Point Shipyard
IC	institutional control
IR	Installation Restoration
LLRW	low-level radioactive waste
LLWPA	Low-Level Radioactive Waste Policy Act
MCL	maximum contaminant level
mrem	millirem
mrem/y	millirems per year
mSv	millisievert
NARM	naturally occurring and accelerator-produced radioactive material
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NORM	naturally occurring radioactive material
NRC	Nuclear Regulatory Commission
pCi/g	picocurie per gram
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act

ABBREVIATIONS AND ACRONYMS
(Continued)

RG	regulatory guideline
ROC	radionuclide of concern
ROD	Record of Decision
TBC	to be considered
TEDE	total effective dose equivalent
TENORM	technically enhanced naturally occurring radioactive material
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment
UMTRCA	Uranium Mill Tailings Radiation Control Act
USC	United States Code

1.0 PURPOSE

This appendix identifies and evaluates potential federal and State of California applicable or relevant and appropriate requirements (ARARs), based on regulations, requirements, and guidance, and sets forth the Department of Navy (DON) determinations on those potential ARARs for each remedial action alternative retained for detailed analysis in this radiological addendum to the Parcel B Technical Memorandum in Support of a Record of Decision Amendment (TMSRA), San Francisco, California.

This evaluation includes an initial determination of whether the potential ARARs actually qualify as ARARs, and a comparison for stringency between the federal and state regulations to identify the controlling ARARs. The identification of ARARs is an iterative process. The final determination of ARARs will be made by the DON in the Record of Decision (ROD) or Action Memorandum, after public review, as part of the response action selection process.

1.1 SUMMARY OF CERCLA AND NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN REQUIREMENTS

Section (§) 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, 42 United States Code [USC] Section [§] 9621[d]), as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site (U.S. Environmental Protection Agency [EPA], 1988). A requirement must be determined to be both relevant and appropriate in order to be considered an ARAR. The criteria for determining relevance and appropriateness are listed in 40 Code of Federal Regulations (CFR), Part 300.400(g)(2) and include the following:

- The purpose of the requirement and the purpose of the CERCLA action
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site
- The substances regulated by the requirement and the substances found at the CERCLA site
- The actions or activities regulated by the requirement and the response action contemplated at the CERCLA site
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- The type of place regulated and the type of place affected by the release or CERCLA action
- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action
- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site

According to CERCLA ARARs guidance (EPA, 1988), a requirement may be "applicable" or "relevant and appropriate," but not both. Identification of ARARs must be done on a site-specific basis and involve a two-part analysis: first, a determination whether a given requirement is applicable; and second, when the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (EPA, 1988).

Tables included in this appendix present each potential ARAR with an initial determination of ARAR status (i.e., applicable, relevant and appropriate, to be considered, or not an ARAR). For the determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements addressed problems or situations sufficiently similar to the circumstances of the release of response action contemplated, and whether the requirement was well suited to the site. A negative determination of relevance and appropriateness indicates that the requirement did not meet the pertinent criteria. Negative determinations are documented in the tables of this appendix.

To qualify as a state ARAR under CERCLA and National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a state requirement must be:

- A state law or regulation
- An environmental or facility siting law or regulation
- Promulgated (of general applicability and legally enforceable)
- Substantive (not procedural or administrative)
- More stringent than federal requirements

- Identified in a timely manner
- Consistently applied

To constitute an ARAR, a requirement must be substantive. Therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered ARARs. Permits are considered procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or non-environmental, including permit requirements, are not considered ARARs. CERCLA 121(e)(1), Title 42 USC § 9621(e)(1), states, "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term "on-site" is defined for this ARAR discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (40 CFR, Part 300.5).

Nonpromulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. Such requirements may, however, be useful, and are "to be considered" (TBC). TBC requirements complement ARARs but do not override them (40 CFR, Part 300.4700[g][3]). They are useful for guiding decisions regarding cleanup goals or methodologies when regulatory standards are not available.

Pursuant to EPA guidance (EPA, 1988), ARARs are generally divided into three categories: chemical-specific, location-specific, and action-specific requirements. This classification was developed to aid in identifying ARARs; some ARARs do not fall precisely into one group or another. ARARs are identified on a site-specific basis for remedial actions where CERCLA authority is the basis for cleanup.

As the lead federal agency, the DON has primary responsibility for identifying federal ARARs at Hunters Point Shipyard (HPS) Parcel B. Potential federal ARARs are discussed in Section 1.2.2. Pursuant to the definition of on-site in 40 CFR, Part 300.5, the on-site areas that are part of this action include all of Parcel B.

Identification of potential state ARARs was initiated through DON requests that the California Department of Toxic Substances Control (DTSC), the Regional Water Quality Control Board, and the San Francisco Bay Conservation and Development Commission identify potential state ARARs. Potential State ARARs that have been identified for Parcel B are discussed below.

1.2 DESCRIPTION OF METHODOLOGY

The process of identifying and evaluating potential federal and state ARARs is described in this subsection.

1.2.1 General

As the lead federal agency, the DON has primary responsibility for identification of potential ARARs for Parcel B. In preparing this ARARs analysis, the DON undertook the following measures, consistent with CERCLA and the NCP:

- Identified potential federal ARARs for each response action alternative in this Radiological Addendum to the TMSRA, taking into account site-specific information for Parcel B
- Reviewed potential state ARARs identified by the state to determine whether they satisfied CERCLA and NCP criteria that must be met to constitute state ARARs
- Evaluated and compared federal ARARs and their state counterparts to determine whether state ARARs were more stringent than the federal ARARs or were in addition to the federally required actions
- Reached a conclusion as to which federal and state ARARs were the most stringent or "controlling" for each alternative

Section 3.1 of this Radiological Addendum to the TMSRA discusses and presents the remedial action objectives (RAO) for the remedial actions at Parcel B. The RAOs for the radionuclides of concern (ROCs) are identified below:

- Prevent or reduce exposure to ROCs in impacted buildings and structures, soils of former building sites, fill areas, remediated storm drains, and sanitary sewers above the cleanup goals developed and shown in Table 3-2 of this Radiological Addendum to the TMSRA for the following pathways:
  - Direct exposure to gamma radiation
  - Ingestion of soils
  - Inhalation of soils

The alternatives for performing the RAOs evaluated in this Radiological Addendum to the TMSRA are:

- Alternative S-1 – No Action
- Alternative S-2 – Institutional Controls, Maintained Landscaping, and Shoreline Revetment
- Alternative S-3 – Excavation, Methane and Mercury Source Removal, Disposal, Institutional Controls, Maintained Landscaping, and Shoreline Revetment
- Alternative S-4 – Covers, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment
- Alternative S-5 – Excavation, Methane and Mercury Source Removal, Disposal, Covers, Soil Vapor Extraction, Institutional Controls, and Shoreline Revetment

- Alternative GW-1 – No Action
- Alternative GW-2 - Long-Term Groundwater Monitoring and Institutional Controls
- Alternative GW-3A and GW-3B – In-Situ Treatment, Groundwater Monitoring, and Institutional Controls
- Alternative R-1 – No Action
- Alternative R-2 – Survey, Decontamination, Disposal, Release, and Institutional Controls
- Alternative R-3 – Survey, Decontamination, Disposal, Release, Close In-Place, and Institutional Controls

1.2.2 Identifying and Evaluating Federal ARARs

As the lead federal agency, the DON has primary responsibility for identification of potential ARARs for HPS Parcel B. The final identification of ARARs will be in the amended ROD. EPA guidance recommends that the lead federal agency consult with the state when identifying potential state ARARs for remedial actions (EPA, 1988). In conjunction with amending the ROD, the DON requested that the state identify potential ARARs in October 2003. On December 24, 2003, Department of Toxic Substances (DTSC) responded and identified potential state ARARs. This response also included potential state ARARs identified by the Department of Fish and Game and the California Department of Public Health (CDPH). The Water Board also submitted a response that identified potential state ARARs for remediation of soil and groundwater. To qualify as a state ARAR under CERCLA and the NCP, a state requirement must be 1) a standard, requirement, criterion, or limitation under a state environmental or facility siting law; 2) promulgated (of general applicability and legally enforceable); 3) substantive (not procedural or administrative); 4) more stringent than the federal requirement; 5) identified by the state in a timely manner; and 6) consistently applied. Requirements identified by these state agencies that the DON identified as potential ARARs are presented in Appendix C.

The components of the proposed response action were reviewed to determine if they were applicable or relevant and appropriate using the CERCLA and NCP criteria and procedures for ARARs identification by lead federal agencies.

EPA guidance recommends that the lead federal agency consult with the state when identifying state ARARs for remedial actions (EPA, 1988). In essence, the CERCLA and NCP requirements at 40 CFR, Part 300.515 for remedial actions provide that the lead federal agency request that the state identify chemical-specific and location-specific state ARARs upon completion of site characterization. The requirements also provide that the lead federal agency request identification of all categories of state ARARs (chemical-, location-, and action-specific) upon completion of identification of remedial alternatives for detailed analysis. As part of the agreement, the DON is responsible for identifying potential federal ARARs, and DTSC is

responsible for coordinating with state and local governmental agencies and identifying potential state ARARs.

2.0 CHEMICAL-SPECIFIC ARARs

Chemical-specific ARARs are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in establishment of a cleanup goal. Many potential ARARs associated with particular response alternatives (such as closure or discharge) can be characterized as action-specific but include numerical values or methodologies to establish them so they fit in both categories (chemical- and action-specific).

This section presents ARARs addressing numerical values for the cleanup of radiologically contaminated equipment, structures, air, and soils and will not repeat the ARARs already presented in the Parcel B TMSRA. Potential federal and state chemical-specific ARARs are summarized in Tables C.2-1 and C.2-2 at the end of this appendix.

2.1 POTENTIAL FEDERAL AND CALIFORNIA STATE CHEMICAL-SPECIFIC ARARS

2.1.1 Radioactive Waste Categorization

Low-Level Radioactive Waste

The definition of low-level (radioactive) waste (LLRW) is found within Nuclear Regulatory Commission (NRC) licensing regulations. It encompasses materials slightly above natural radiation background levels to highly radioactive materials that require extreme caution when handling. The term "low-level radioactive waste" means radioactive material that: 1) is not high-level radioactive waste, spent nuclear fuel, or byproduct material (the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content) and 2) the NRC classifies as low-level radioactive waste (LLRW Policy Act at Title 42 USC §§ 2021[b][9] and 2014[e][2]).

Low-level radioactive waste includes items with radioactive material or materials that have become radioactive through exposure to neutron radiation. This waste typically consists of contaminated protective shoe covers and clothing, wiping rags, mops, filters, reactor water treatment residues, equipment and tools, luminous dials (containing tritium or other non-radium radionuclides), medical tubes, swabs, injection needles, syringes, and laboratory animal carcasses and tissues. The radioactivity can range from just above naturally occurring background levels to very high levels. LLRW does not include naturally occurring and accelerator-produced radioactive material (see below).

Naturally Occurring and Accelerator-Produced Radioactive Waste

Naturally occurring and accelerator-produced radioactive material (NARM) is a broad category that includes accelerator-produced radioactive material and naturally occurring radioactive

material (NORM), but does not include source, special nuclear, or by-product material. NORM is a subset of NARM. Accelerator-produced radioactive materials (the "A" in NARM) include wastes generated by accelerators used in subatomic particle physics research.

The term technically enhanced NORM (TENORM) refers to NORM whose radioactivity has been enhanced (i.e., NORM whose radionuclide concentrations are either increased or redistributed compared to typical background levels either naturally or as the result of human intervention or processes). Examples are exploration and production wastes from the oil and natural gas industries and phosphate slag piles from the phosphate mining industry.

Currently, no federal regulations specifically control NARM (NRC regulations do not include NARM at this time). However, numerous federal laws do regulate parts of the NORM/TENORM industry. An example is the maximum contaminant level (MCL) for radium.

2.1.2 Authority and Responsibility for Radioactive Waste

The Atomic Energy Act (AEA), as amended, is the basic law governing production, use, ownership, and disposal of, and liability for, radioactive materials in the United States. A number of laws also specify radioactive-waste-management procedures and authorities. In 1980, Congress passed the Low-Level Radioactive Waste Policy Act (LLWPA; amended in 1985, LLWPA Amendment) that stipulated disposal of non-Department of Energy (DOE) LLRW as a responsibility of the states and the disposal of commercial transuranic waste and "greater than Class C" LLRW (see Title 10 CFR § 61.55 for waste categories) a federal responsibility. According to these laws, the EPA must set radiation protection standards for disposal of LLRW, supplementing standards set by NRC. However, the EPA has not as yet established this regulation. Recent amendments to the AEA, in the Energy Policy Act of 2005, have brought radium-226 (^{226}Ra), NARM, and NORM under the jurisdiction of the NRC.

In California, regulation of NARM disposal currently rests with the State of California as part of its authority as an Agreement State for ensuring the protection of public health and safety. Even though the State has the authority, the state regulations must be more stringent than the federal ARARs to be potential ARARs.

Responsibilities for management of nuclear materials, including radioactive wastes, are defined in the above-mentioned laws passed by Congress. These laws are administered by government agencies that codify the details in the CFR, in guidance documents, and in internal orders. Responsibilities for action, monitoring, enforcement, and setting standards are divided between several agencies. DOE, EPA, NRC, and the Department of Transportation are all involved in different aspects of radioactive waste management for DOE projects on the federal level. Management of wastes from other generators involves the same agencies and includes DOE for high-level waste and greater-than-Class-C LLRW.

Using AEA authority, the NRC and DOE regulate mixed waste with regard to radiation safety. Using Resource Conservation and Recovery Act (RCRA) authority, EPA regulates mixed waste with regard to hazardous waste safety. Once a waste is determined to be a mixed waste, the DON must comply with both AEA and RCRA statutes and regulations. The requirements of RCRA and AEA are generally consistent and compatible.

California Radioactive Waste Categorization

State radioactive waste standards are provided at California Code Regulations (CCR) Title 17 § 30253. The State standards incorporate most of 10 CFR Part 20 by reference but they do exclude certain key NRC requirements including the license termination provisions of 10 CFR § 20.1402, 20.1403, 20.1404.

The contaminated soil at Parcel B has been determined to be NARM. Substantive federal requirements of the NRC are potentially relevant and appropriate for the NARM at Parcel B since HPS is not an NRC licensee. The State requirements are not more stringent than federal ARARs, and hence could not be potential ARARs even if they had been identified by the State as State ARARs.

NRC Licensing Regulations for Land Disposal of Radioactive Waste

The requirements to obtain a license are not potential ARARs since they are not substantive. The Navy investigates and responds to hazardous substances released from its sites in a remedial action selected pursuant to its authority under Section 104 of CERCLA as amended, the Defense Environmental Restoration Program (DERP) (10 USC § 2701, et seq.), and federal Executive Order 12580 as amended. The DON's CERCLA remedial action selection decision will address all hazardous substances released at the site, including radionuclides, and will be memorialized in a ROD.

Permits, licenses or similar regulatory approvals are required for a CERCLA response action. More specifically, Section 121(e)(1) of CERCLA states that "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term on-site is defined as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (40 CFR § 300.5).

NRC Licensing Requirements for Land Disposal of Radioactive Waste (10 CFR Part 61, Subparts C and D) are not potentially applicable since the site is not an NRC-licensed site. Obtaining a license is not a potential ARAR since CERCLA actions are exempt from procedural and administrative provisions and are exempt from having to obtain a permit of any kind. However, the substantive performance objectives for the land disposal of LLRW may be relevant

and appropriate for sites containing radioactive waste similar to LLRW. See Section 3.2.4.4 for the radioactive waste classification discussion. The requirements at 10 CFR § 61.40 state that land disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposure to humans is within the limits established in the performance objectives in 10 CFR § 61.41–61.44. The requirements at 10 CFR § 61.41 are discussed as chemical-specific requirements. The requirements of 10 CFR § 61.42 state that design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed.

The requirements of 10 CFR § 61.43 state that operations at the land disposal facility must be conducted in compliance with the standards for radiation protection set out in Part 20 of this chapter, except for releases of radioactivity in effluents from the land disposal facility, which shall be governed by 10 CFR § 61.41. Every reasonable effort shall be made to maintain radiation exposures as low as reasonably achievable (ALARA).

The requirements of 10 CFR § 61.44 state that the disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required.

The NRC has standards for protection against radiation for waste disposal at 10 CFR § 20.2001–§ 20.2006. Under 10 CFR § 20.2001(a) disposal of regulated material is allowed only by 1) transfer to an authorized recipient; 2) by decay in storage; or 3) by release in effluents within the limits in §20.1301 or as authorized under § 20.2002, 20.2003, or 20.2004 (described below).

The substantive provisions of 10 CFR § 20.2002 (d) that require analyses and procedures to ensure that doses are maintained ALARA and within the dose limits in Part 20 are not potentially relevant and appropriate since HPS is not an NRC licensee nor are Installation Restoration (IR)-07 and IR-18 licensed disposal facilities.

NRC Standards for Protection Against Radiation

The substantive radiological criteria for termination of a license for an existing NRC-licensed, radioactive waste-contaminated site when future unrestricted use is proposed are found at 10 CFR § 20.1402. These regulations provide that a site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from (i.e., above) background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 millirems (mrem) (or 0.25 millisievert [mSv]) per year, including that contributed from groundwater sources of drinking water, and that the residual radioactivity has been reduced to levels ALARA. The TEDE is the sum of the deep-dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures). These

criteria apply only to ancillary surface facilities that support radioactive waste disposal activities regulated as discussed earlier, under 10 CFR Part 61.

The radium in soil at Parcel B is similar to radioactive waste regulated at an NRC site. The substantive provisions of 10 CFR § 20.1402 are potentially relevant and appropriate for an unrestricted land use scenario at Parcel B (all Parcel B-impacted sites except IR-07 and IR-18). Portions of Parcel B (IR-07/18) will require land use restrictions after the remedial action.

NRC Radiation Dose Limits for Individual Members of the Public

Radiation dose limits for the public are required in the substantive provisions of 10 CFR §20.1301. This section requires that the TEDE to individual members of public not exceed 100 millirems per year (mrem/y) from licensed operations.

NRC licenses the following activities:

- Construction, operation, and decommissioning of commercial reactors and fuel cycle facilities
- Possession, use, processing, exporting, and certain aspects of transporting nuclear materials and waste
- Siting, design, construction, operations, and closure of waste disposal sites

The proposed Alternatives S-1, S-2, and S-4 for Parcel B include leaving radioactive waste on site but not licensing the waste disposal site. Since the proposed action is not similar to the regulated activity of closure of waste disposal sites (not an NRC license) and the action is addressing similar wastes as those regulated, the substantive radiation dose limits for the public at 10 CFR §20.1301 are not potentially relevant and appropriate.

Uranium Mill Tailings Radiation Control Act

The Uranium Mill Tailings Radiation Control Act (UMTRCA) standards are not applicable to HPS because it is not a mill site to which UMTRCA standards specifically apply. Specific UMTRCA requirements are therefore evaluated as to whether they are potentially relevant and appropriate for the remedial action at HPS.

Substantive requirements for cleanup of radioactive contaminants are found in UMTRCA standards for land and buildings contaminated with residual radioactive materials from inactive uranium processing sites. Dose limits for ^{226}Ra in soil are found at 40 CFR § 192.12(a), § 192.32(b)(2), and § 192.41, which state that as a result of residual radioactive materials from any designated processing site:

(a) The concentration of ^{226}Ra in land averaged over any area of 100 square meters shall not exceed the background level by more than

(1) 5 picocuries per gram (pCi/g), averaged over the first 15 centimeters (cm) of soil below the surface, and

(2) 15 pCi/g, averaged over 15-cm-thick layers of soil, more than 15 cm below the surface.

The substantive provisions of 40 CFR § 192.12(a)(1), § 192.32(b)(2), and § 192.41 have been determined to be potentially relevant and appropriate for surface contamination at Parcel B IR-07 and IR-18 since the radioactive contaminants are similar to those found at uranium mill sites. The subsurface contaminant level is expected to be between 5 pCi/g to 30 pCi/g, which does not match that of a regulated Title I site; therefore, the subsurface concentration of 15 pCi/g at 40 CFR § 192.12(a)(2) is not potentially relevant and appropriate.

The criteria at 10 CFR Part 40 Appendix A, Part I, Criterion 6(6) provide a benchmark approach for setting radionuclide cleanup levels as a supplement to 40 CFR Part 192.

The substantive provisions of 40 CFR § 192.12(b)(1) and § 192.41(b) are not determined to be potentially relevant and appropriate to the building structures at Parcel B because radium contamination is not proposed to be left in buildings.

A concentration limit for gamma radiation in buildings at inactive uranium processing sites designated for remedial action is provided at 40 CFR § 192.12(b)(2). This requirement states that the level of gamma radiation in any occupied or habitable building shall not exceed the background level by more than 20 microroentgens per hour.

Parcel B IR-07 and IR-18 has the potential to emit gamma radiation; therefore, the substantive provisions of 40 CFR § 192.12(b)(2) are potentially relevant and appropriate. However, the existing levels of gamma radiation already meet these requirements.

NESHAPS Requirements for Radionuclides

Emission limitations are provided under National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for facilities owned or operated by the DOE that emit radionuclides other than Radon-222 and Radon-220 into the air. Under 40 CFR part 61 subpart H §61.92, emissions of radionuclides into the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/y.

Under 40 CFR part 61 subpart I §61.102, emissions of iodine into the ambient air from a facility regulated under this subpart shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 3 mrem/y. Similarly, emissions of all radionuclides (including iodine), shall not exceed amounts that would cause an effective dose equivalent of 10 mrem/y.

These requirements are limited to the cleanup action at a CERCLA site. Part II of the CERCLA Compliance with Other Laws Manual states:

> *"...these subparts (Subparts H and I) would not be applicable or relevant and appropriate for airborne emissions from residual contamination after cleanup, when the facility is no longer in operation (the standards were developed to limit radiation doses caused by operations that yield a beneficial product)."*

Therefore, after removal or handling of radionuclide waste at a site, the requirements under subparts H and I of 40 CFR Part 61 are not ARARs.

Remedial Action with Release of the Site for Restricted Use

At some sites the remedial action conducted by the DON (Alternatives S-2, S-3, S-4, and S-5) may result in containment of potential residual LLRW. This type of remedial action may include one or both of the following general actions:

- ***Capping and Land-use Controls:*** This remedial action generally includes construction of cap with minimum disturbance of the waste or contaminated soil. Additionally, institutional and engineering controls are implemented to protect the integrity of the cap, and human health and the environment under restricted use.
- ***Partial Removal/Remediation of Contaminated Media:*** This remedial action generally includes removal or remediation of the radioactive media to the levels protective of human health under restricted use. In addition, institutional and engineering controls are implemented to protect human health and the environment.

2.1.2.1 Capping and Institutional Controls

Potential federal ARARs are contained in NRC's Radiological Criteria for Restricted Use at 10 CFR § 20.1403 and substantive provisions of alternative criteria included in license termination regulations at 10 CFR § 20.1404. The Navy has proposed Preliminary Remediation Goals ("PRGs") for the ROCs for Parcel B remedial action in Table 3-2 of the TMSRA RA as provided by Section 300.430(e)(2) of the NCP. The PRGs and remedial actions for Parcel B are protective of human health and the environment and are more stringent and protective than the criteria in 10 CFR § 20.1403.

Therefore, the requirements of 10 CFR Section 20.1403 have not been carried forward for further analysis as a potential CERCLA chemical-specific federal ARAR.

Substantive requirements that may be relevant and appropriate federal ARARs for the capping action are contained in subparts C and D of 10 CFR Part 61. Subpart C of 10 CFR Part 61 contains performance objectives for land disposal facilities including the exposure limitations for the members of the public and implementation of mechanisms to protect inadvertent intrusion

into the disposal site. The substantive provisions of the following 10 CFR Part 61, subpart C regulations are potentially relevant and appropriate ARARs:

> "Concentrations of radioactive material which may be released to the general environment in ground water, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 millirem to the whole body, 75 millirem to the thyroid, and 25 millirem to any other organ of any member of the public. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable" (10 CFR § 61.41).
>
> "Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed." (10 CFR § 61.42)

Subpart D of 10 CFR Part 61 contains technical requirements for siting, design, and operation of the land disposal facility. Some examples of the technical requirements include prohibition of siting of the disposal facility in 100-year flood plain or area prone to faulting, seismic activity, or volcanism with such frequency as to significantly affect the ability of the disposal site to meet the performance objectives of Subpart C; design of the covers to minimize water infiltration; design of surface features to minimize erosion of the cover; and segregation of radiological waste pursuant to 10 CFR § 61.55 before disposal.

Because State licensing requirements are applicable to any radioactive material, these requirements may be potentially applicable at most DON sites if it is proposed that radiological constituents not exempt by the state regulations be left in place. However, even though the State requirements at CCR title 17 §§ 30190 and 30194 may be applicable, substantive provisions of these State requirements must be more stringent than federal ARARs to be potential ARARs. Because federal regulations at 10 CFR 20 have been identified as potential relevant and appropriate ARARs, the comparable State requirements that are not more stringent are not potential ARARs.

The requirements to obtain a license are not potential ARARs since they are not substantive. The DON investigates and responds to hazardous substances released from its IR sites in a remedial action selected pursuant to its authority under Section 104 of CERCLA as amended, the DERP (10 USC § 2701, et seq.), and federal Executive Order 12580 as amended. CERCLA remedial actions at DON sites will address all hazardous substances released at the site, including radionuclides, and will be memorialized in a ROD.

Remedial Action with Release of the Site for Unrestricted Radiological Use

This remedial action alternative is conducted to release a site for unrestricted reuse. The potential federal ARARs are contained in NRC's Radiological Criteria for Unrestricted Use at 10 CFR § 20.1402. The substantive provisions of the following regulation are potential ARARs:

"A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable for background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 millirems per year including that from groundwater sources of drinking water, and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA)."

3.0 LOCATION-SPECIFIC ARARs

Potential location-specific ARARs are identified and discussed in this section and are presented in Table C.3-1, included at the end of this appendix.

3.1 SUMMARY OF LOCATION-SPECIFIC ARARS

Eight protected resource categories are associated with location-specific ARARs: 1) cultural resources, 2) wetlands protection, 3) floodplain management, 4) hydrological resources, 5) biological resources, 6) coastal resources, 7) other natural resources, and 8) geologic characteristics. Cultural and coastal resources are the only categories of protected resources affected by the radiological response actions at Parcel B.

3.1.1 Potential Federal and State Location-specific ARARs

The only federal and State ARAR that is not specified in the TMSRA (SulTech, 2006) is:

- 16 USC §§ 470-470x-6, 36 CFR Part 800, and 40 CFR Part 6.301(b) is applicable and requires that actions preserve historic properties and that planning of action will minimize harm to properties listed on or eligible for listing on the national Register of Historic Places (Building 140 and its discharge channel).

4.0 ACTION-SPECIFIC ARARs

The DON is evaluating several alternatives for the remediation of radionuclides from Parcel B. The requirements determined to be pertinent to each alternative being evaluated for the Parcel B action are discussed. Table C.4-1, included at the end of this appendix, presents the potential action-specific ARARs.

Action-specific ARARs are technology- or activity-based requirements or limitations for remedial activities. These requirements are triggered by the specific remedial activities conducted at the site and indicate how a selected remedial alternative should be achieved. The DON has identified potential action-specific ARARs for the soil, groundwater, and impacted Parcel B building alternatives evaluated in this radiological addendum to the TMSRA.

4.1 REMEDIAL ALTERNATIVES FOR RADIONUCLIDES

The TMSRA identifies five soil and three groundwater alternatives for impacted sites in Parcel B. This addendum presents three alternatives for radiologically-impacted sites in Parcel B. The alternatives are described in the following sections.

4.1.1 Alternative S-1, GW-1, and R-1 – No Action

There is no need to identify action-specific ARARs for the no-action alternatives because ARARs apply to "any removal or remedial action conducted entirely "on-site" and "no action" is not a removal or remedial action.

4.1.2 Alternative S-2: Institutional Controls Maintained Landscaping, and Shoreline Revetment

Under this alternative, the DON would institute institutional controls (ICs) over all the redevelopment blocks to prevent an unacceptable risk. These ICs would restrict use of the soils to approved ROD amendment activities.

4.1.2.1 Potential Federal and State Chemical-specific ARARs

There are no additional federal or state chemical-specific ARARs that are applicable for Alternative S-2 that are not already referenced in the TMSRA (SulTech, 2006). However, the substantive provisions of the following potential radiation-specific requirements were identified as potentially relevant and appropriate for the remediation of radiologically-impacted sites:

- Radiation Dose Limits for Individual Members of the Public (10 CFR § 20.1301)
- Standards for Protection Against Radiation (10 CFR 20.1402)
- Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites at 40 CFR § 192.12(a)

4.1.2.2 Potential Federal and State Location-specific ARARs

There are no additional federal or state location-specific ARARs for Alternative S-2 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.2.3 Potential Federal and State Action-specific ARARs

There are no additional federal or state action-specific ARARs for Alternative S-2 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.3 Alternative S-3: Excavation, Methane and Mercury Source Removal, Disposal, Maintained Landscaping, Institutional Controls, and Shoreline Revetment

Under this alternative, the DON would perform surveys and excavation (removal) of any potentially present ROCs in soils associated with the remediated storm drains and sanitary sewers. The radioactive material recovered in this action would be containerized and disposed of at a licensed off-site facility. ICs would be implemented for all the redevelopment blocks to prevent exposure resulting in an unacceptable risk.

4.1.3.1 Potential Federal and State Chemical-specific ARARs

There are no additional federal or state chemical-specific ARARs that are applicable for Alternative S-3 that are not already referenced in the TMSRA (SulTech, 2006). However, the substantive provisions of the following potential radiation-specific requirements were identified as potentially relevant and appropriate for the remediation of radiologically-impacted sites:

- Radiation Dose Limits for Individual Members of the Public (10 CFR § 20.1301)
- Standards for Protection Against Radiation (10 CFR 20.1402)
- Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites at 40 CFR § 192.12(a)

4.1.3.2 Potential Federal and State Location-specific ARARs

There are no additional federal or state location-specific ARARs for Alternative S-3 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.3.3 Potential Federal and State Action-specific ARARs

There are no additional federal or state action-specific ARARs for Alternative S-3 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.4 Alternative S-4: Covers, Methane and Mercury Source Removal, Disposal, Institutional Controls, and Shoreline Revetment

Under this alternative, the DON would install covers over all the redevelopment blocks and institute ICs for all redevelopment blocks to prevent exposure resulting in an unacceptable risk.

4.1.4.1 Potential Federal and State Chemical-specific ARARs

There are no additional federal or state chemical-specific ARARs that are applicable for Alternative S-4 that are not already referenced in the TMSRA (SulTech, 2006). However, the substantive provisions of the following potential radiation-specific requirements were identified as potentially relevant and appropriate for the remediation of radiologically-impacted sites:

- Radiation Dose Limits for Individual Members of the Public (10 CFR § 20.1301)
- Standards for Protection Against Radiation (10 CFR 20.1402)
- Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites at 40 CFR § 192.12(a)

4.1.4.2 Potential Federal and State Location-specific ARARs

There are no additional federal or state location-specific ARARs for Alternative S-4 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.4.3 Potential Federal and State Action-specific ARARs

There are no additional federal or state action-specific ARARs for Alternative S-4 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.5 Alternative S-5: Excavation, Methane and Mercury Source Removal, Disposal, Covers, Soil Vapor Extraction, Institutional Controls, and Shoreline Revetment

Under this radiological alternative, the DON would perform surveys and removal of any potentially present ROCs in surface soils associated with former building sites, soils associated with remediated storm drains and sanitary sewers, and fill areas. The radioactive material recovered in this action would be containerized and disposed of at a licensed off-site facility. ICs would be implemented for all redevelopment blocks to prevent exposure resulting in an unacceptable risk.

4.1.5.1 Potential Federal and State Chemical-specific ARARs

There are no additional federal or state chemical-specific ARARs that are applicable for Alternative S-5 that are not already referenced in the TMSRA (SulTech, 2006). However, the substantive provisions of the following potential radiation-specific requirements were identified as potentially relevant and appropriate for the remediation of radiologically-impacted sites:

- Radiation Dose Limits for Individual Members of the Public (10 CFR § 20.1301)
- Standards for Protection Against Radiation (10 CFR 20.1402)
- Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites at 40 CFR § 192.12(a)

4.1.5.2 Potential Federal and State Location-specific ARARs

There are no additional federal or state location-specific ARARs for Alternative S-5 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.5.3 Potential Federal and State Action-specific ARARs

There are no additional federal or state action-specific ARARs for Alternative S-5 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.6 Alternative GW-2: Long-Term Monitoring of Groundwater and Institutional Controls

Alternative GW-2 consists of groundwater monitoring and institutional controls. This alternative was developed as a method for monitoring contaminants present at low concentrations in groundwater. Groundwater monitoring for the ROCs will be used to confirm site conditions and ensure that, over time, the potential exposure pathway remains incomplete.

4.1.6.1 Potential Federal and State Chemical-specific ARARs

There are no additional Federal or State chemical-specific ARARs for Alternative GW-2 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.6.2 Potential Federal and State Location-specific ARARs

There are no additional federal or state location-specific ARARs for Alternative GW-2 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.6.3 Potential Federal and State Action-specific ARARs

There are no additional federal or state action-specific ARARs for Alternative GW-2 that are not already referenced in the TMSRA (SulTech, 2006).

4.1.7 Alternative GW-3A and GW-3B: In-Situ Treatment, Groundwater Monitoring, and Institutional Controls

Alternatives GW-3A and GW-3B consist of in-situ treatment of the contaminant plumes in addition to groundwater monitoring and institutional controls similar to Alternative GW-2. Groundwater monitoring for the ROCs will be used to confirm site conditions and ensure that, over time, the potential exposure pathway remains incomplete.

4.1.7.1 Potential Federal and State Chemical-specific ARARs

There are no additional federal or state chemical-specific ARARs for Alternative GW-3A and GW-3B that are not already referenced in the TMSRA (SulTech, 2006).

4.1.7.2 Potential Federal and State Location-specific ARARs

There are no additional federal or state location-specific ARARs for Alternative GW-3A and GW-3B that are not already referenced in the TMSRA (SulTech, 2006).

4.1.7.3 Potential Federal and State Action-specific ARARs

There are no additional federal or state action-specific ARARs for Alternative GW-3A and GW-3B that are not already referenced in the TMSRA (SulTech, 2006).

4.1.8 Alternative R-2: Survey, Decontamination, Disposal, Release, and Institutional Controls

Under Alternative R-2 remedial actions will be taken to remove ROCs that are present at radiologically-impacted buildings above the regulatory guidelines (RGs). These remedial actions may consist of decontamination of radiologically-impacted buildings and dismantlement of building structures if necessary. The buildings, except for Building 140, will be surveyed to verify that no residual radioactivity is present above the RGs.

The above-grade portions of Building 140, the discharge tunnel, and the first 10 feet of the Building 140 Shaft will be surveyed to verify that no residual radioactivity is present above the RAOs. The Building 140 Shaft below 10 feet will be abandoned as is due to the unsound condition of the building, health and safety hazards associated with field conditions, as well as many other unknowns. ICs will be implemented to minimize inadvertent contact with radiologically-impacted media.

The soils of former building sites will be surveyed to verify that no residual radioactivity is present above the RGs. Limited soils excavation at former building sites may be performed to remove radiologically-impacted soils.

The trenches resulting from sewer and storm line removal, and soils of remediated storm drains and sanitary sewers will be surveyed to verify that residual radioactivity is not present above the RGs. The radiologically-impacted storm drains and sanitary sewers will be removed under this alternative.

A surface scan will be performed at IR Sites 07 and 18. Limited soil excavations will be performed to remove radiological anomalies down to one foot. The excavated areas will be backfilled with clean material to grade. Institutional controls will be utilized to prevent exposure to potentially unacceptable risk by the soil left in place.

4.1.8.1 Potential Federal and State Chemical-specific ARARs

Potential federal and state chemical-specific ARARs for Alternative R-2 are presented in Tables C.2-1 and C.2-2, respectively.

4.1.8.2 Potential Federal and State Location-specific ARARs

Potential federal and state location-specific ARARs for Alternative R-2 are presented in Table C.3-1.

4.1.8.3 Potential Federal and State Action-specific ARARs

Potential federal and state action-specific ARARs for Alternative R-2 are presented in Table C.4-1.

4.1.9 Alternative R-3: Survey, Decontamination, Disposal, Release, Close In-Place, and Institutional Controls

Under Alternative R-3 remedial actions will be taken to remove ROCs that are present at radiologically-impacted buildings above the RGs with the exception of Building 140. These remedial actions may consist of decontamination of radiologically-impacted buildings and dismantlement of building structures if necessary. The building will be surveyed to verify that no residual radioactivity is present above the RGs.

Under this alternative the above-grade portions of Building 140, the discharge tunnel, and the first 10 feet of the Building 140 Shaft will be surveyed to verify that no residual radioactivity is present above the RGs. The shaft in Building 140 below 10 feet will not be remediated. The shaft below 10 feet and connecting piping will be closed in-place with backfilled stone and a concrete cap. Institutional controls will be utilized to prevent exposure to potentially unacceptable risk by the ROCs left in place.

The soils of former building sites will be surveyed to verify that no residual radioactivity is present above the RGs. Limited excavation of the soils at former building sites may be performed to remove radiologically-impacted soils.

The trenches resulting from sewer and storm line removal, and soils of remediated storm drains and sanitary sewers will be surveyed to verify that residual radioactivity is not present above the RGs. The radiologically-impacted storm drains and sanitary sewers will be removed under this alternative.

A surface scan will be performed at IR Sites 07 and 18. Limited soil excavations will be performed to remove radiological anomalies down to one foot. The excavated areas will be backfilled with clean material to grade. Subsequently, an engineering control comprising a two-foot soil cap will be installed at and above original grade. A method of demarcation will be

utilized to ensure proper identification of the bottom of the soil cap. The proposed soil cap will effectively reduce the dose and residual risk associated with ROCs at the release criteria at and below the original surface to the levels prescribed in the RAOs. Institutional controls will be utilized to prevent exposure to potentially unacceptable risk by the soil left in place and preserve the integrity of the soil cap.

4.1.9.1 Potential Federal and State Chemical-specific ARARs

Potential federal and state chemical-specific ARARs for Alternative R-3 are presented in Tables C.2-1 and C.2-2 respectively.

4.1.9.2 Potential Federal and State Location-specific ARARs

Potential federal and state location-specific ARARs for Alternative R-3 are presented in Table C.3-1.

4.1.9.3 Potential Federal and State Action-specific ARARs

Potential federal and state action-specific ARARs for Alternative R-3 are presented in Table C.4-1.

5.0 REFERENCES

SulTech. 2006. Parcel B *Technical Memorandum in Support of a Record of Decision.* San Diego SulTech. March 28.

U.S. Environmental Protection Agency (EPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA; Interim Final.* U.S. Environmental Protection Agency Guidance. EPA 540-G-89-004. October.

TABLES

TABLE C.2-1

POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
Resource Conservation and Recovery Act (42 USC, ch. 82, §§ 6901-6991[i]) [b]				
Soil				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste	22 CCR §§66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether waste is hazardous and already identified in the TMSRA.
Toxic Substances control Act (15 USC, ch. 53, §§ 2601-2692) [b]				
Regulates storage and disposal of PCB remediation waste. There are three options: (a) self-implementing on-site cleanup and disposal; (b) performance-based disposal using existing approved disposal technologies; and (c) risk-based disposal.	Soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm	40 CFR §761.61(c)	Not an ARAR	This FS is for radioactive material, not PCBs.
Uranium Mill Tailings Radiation Control Act (42 USC, Chapter 88, §§ 192.02, 192.12(a,b), 192.42) [b]				
Control of residual radioactive materials shall be designed to: Be effective for up to 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years, and, Provide reasonable assurance that releases of ^{222}radon from residual radioactive material into the atmosphere will not: (1) Exceed an average release rate of 20 picocuries per square meter per second. This average shall apply over the entire surface of the disposal site and over at least a one-year period. Radon will come from both residual radioactive materials and from materials covering them. Radon emissions from the covering materials should be estimated as part of developing a remedial action plan for each site. The standard, however, applies only to emissions from residual radioactive materials into the atmosphere.	Inactive Uranium Processing site	40 CFR §192.02(a), (b)	Not an ARAR	Parcel B is not an inactive uranium processing site, hence this citation is not applicable. It is highly unlikely the criteria for releases of ^{222}radon from residual radiological material into the atmosphere would be exceeded at Parcel B.

POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
or, (2) Increase the annual average concentration of ^{222}radon in air at or above any location outside the disposal site by more than 0.5 picocurie per liter.				
Standards for cleanup of land and buildings contaminated with ^{226}radium, ^{228}radium, and thorium from inactive uranium processing sites. As a result of residual radioactive materials from any designated processing site: (a) The concentration of ^{226}radium in land averaged over any area of 100 square meters shall not exceed the background level by more than: (1) 5 pCi/g, averaged over the first 15 cm of soil below the surface, and (2) 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface.	UMTRCA sites	40 CFR Parts 192.12(a), 192.32(b)(2) and 192.41	Relevant and Appropriate	Not applicable because Parcel B is not an UMTRCA site but is potentially relevant and appropriate for sites with soil contaminated with radioactive waste. The surface and subsurface concentration of 5pCi/g is potentially relevant and appropriate only for an unrestricted land-use scenario.
In any occupied or habitable building, the objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL. In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL. Provisions applicable to ^{222}radon shall also apply to ^{220}radon.	UMTRCA sites	40 CFR § 192.12(b)(1) §192.41(b)	Relevant and Appropriate	Not applicable because Parcel B is not an UMTRCA site. Relevant and applicable since the alternatives will result in radioactive material with radioactive contamination that may produce this level of dose.
Concentration limits for cleanup of gamma radiation in buildings at inactive uranium processing sites designated for remedial action. In any occupied or habitable building, the level of gamma radiation shall not exceed the background level by more than	UMTRCA sites	40 CFR §192.12(b)(2)	Relevant and Appropriate	Not applicable because Parcel B is not an UMTRCA site. A potential ARAR since the alternatives will leave a building with radioactive contamination at the remedial action objective level.

POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
20 microroentgens per hour.				
Radiological Criteria for License Termination				
A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in TEDE to an average member of the critical group that does not exceed 25 mrem/y, including that from groundwater sources of drinking water, and that the residual radioactivity has been reduced to ALARA.	Existing NRC-licensed radiologically contaminated site	10 CFR § 20.1402	Relevant and appropriate	This ARAR is potentially relevant and appropriate for an unrestricted land use scenario.
A site will be considered acceptable for license termination under restricted conditions if: (a) The licensee can demonstrate that further reductions in residual radioactivity necessary to comply with the provisions of § 20.1402 would result in net public or environmental harm or were not being made because the residual levels associated with restricted conditions are ALARA. Determination of the levels which are ALARA must take into account consideration of any detriments, such as traffic accidents, expected to potentially result from decontamination and waste disposal; (b) The licensee has made provisions for legally enforceable institutional controls that provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem (0.25 mSv) per year; (c) The licensee has provided sufficient financial assurance to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of	Existing NRC-licensed radiologically contaminated site	10 CFR §20.1403(a),(b),(c),(d),(e)	Not an ARAR	The PRGs and remedial actions for Parcel B are protective of human health and the environment and are more stringent and protective than the criteria in 10 CFR § 20.1403. Therefore, these regulations will not be carried forward in the CERCLA process as potential Federal ARARs.

POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
the site. Acceptable financial assurance mechanisms are-- (1) Funds placed into an account segregated from the licensee's assets and outside the licensee's administrative control as described in § 30.35(f)(1) of this chapter; (2) Surety method, insurance, or other guarantee method as described in § 30.35(f)(2) of this chapter; (3) A statement of intent in the case of Federal, State, or local Government licensees, as described in § 30.35(f)(4) of this chapter; or (4) When a governmental entity is assuming custody and ownership of a site, an arrangement that is deemed acceptable by such governmental entity. (d) The licensee has submitted a decommissioning plan or License Termination Plan (LTP) to the Commission indicating the licensee's intent to decommission in accordance with §§ 30.36(d), 40.42(d), 50.82 (a) and (b), 70.38(d), or 72.54 of this chapter, and specifying that the licensee intends to decommission by restricting use of the site. The licensee shall document in the LTP or decommissioning plan how the advice of individuals and institutions in the community who may be affected by the decommissioning has been sought and incorporated, as appropriate, following analysis of that advice. (1) Licensees proposing to decommission by restricting use of the site shall seek advice from such affected parties regarding the following matters concerning the proposed decommissioning--				

POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
(i) Whether provisions for institutional controls proposed by the licensee; (A) Will provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem (0.25 mSv) TEDE per year; (B) Will be enforceable; and (C) Will not impose undue burdens on the local community or other affected parties. (ii) Whether the licensee has provided sufficient financial assurance to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site; (2) In seeking advice on the issues identified in § 20.1403(d)(1), the licensee shall provide for: (i) Participation by representatives of a broad cross section of community interests who may be affected by the decommissioning; (ii) An opportunity for a comprehensive, collective discussion on the issues by the participants represented; and (iii) A publicly available summary of the results of all such discussions, including a description of the individual viewpoints of the participants on the issues and the extent of agreement and disagreement among the participants on the issues; and				

POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
(e) Residual radioactivity at the site has been reduced so that if the institutional controls were no longer in effect, there is reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group is as low as reasonably achievable and would not exceed either-- (1) 100 mrem (1 mSv) per year; or (2) 500 mrem (5 mSv) per year provided the licensee-- (i) Demonstrates that further reductions in residual radioactivity necessary to comply with the 100 mrem/y (1 mSv/y) value of paragraph (e)(1) of this section are not technically achievable, would be prohibitively expensive, or would result in net public or environmental harm; (ii) Makes provisions for durable institutional controls; (iii) Provides sufficient financial assurance to enable a responsible government entity or independent third party, including a governmental custodian of a site, both to carry out periodic rechecks of the site no less frequently than every 5 years to assure that the institutional controls remain in place as necessary to meet the criteria of § 20.1403(b) and to assume and carry out responsibilities for any necessary control and maintenance of those controls. Acceptable financial assurance mechanisms are those in paragraph (c) of this section.				
Alternate criteria are allowed for license termination as long as assurance is provided that public health and safety would continue to be protected, and that it is unlikely that the dose from all man-made sources combined, other than medical,	Existing NRC-licensed radiologically contaminated site	10 CFR, Part 20.1404(a)(1), (2), and (3)	Not an ARAR	The PRGs and remedial actions for Parcel B are protective of human health and the environment and are more stringent and protective than

POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
would be more than the 100-mrem/y limit of Subpart D, by submitting an analysis of possible sources of exposure; to the extent practical restrictions for on-site use are employed according to the provisions of Part 20.1403 in minimizing exposures at the site; and doses are reduced to ALARA levels, taking into consideration any detriments such as traffic accidents expected to potentially result from decontamination and waste disposal.				the criteria in 10 CFR § 20.1403. Therefore, these regulations will not be carried forward in the CERCLA process as potential Federal ARARs.
Provides a benchmark approach for setting cleanup levels for radionuclides as a supplement to 40 CFR § 192.	UMTRCA site	10 CFR Part 40, Appendix A, Part I, Criterion 6(6)	Not an ARAR	Not applicable because Parcel B is not an UMTRCA site but is potentially relevant and appropriate if soil or structures at the site have a radiation risk and 40 CFR, Part 192 is identified as a potential ARAR.
Performance objectives for the land disposal of LLRW. Concentrations of radioactive material that may be released into the general environment must not result in an annual dose exceeding 25 mrem to the body or any organ of a member of the general public.	Existing NRC-licensed LLRW disposal site	10 CFR § 61.41	Relevant and appropriate	This ARAR is potentially relevant and appropriate for a restricted land-use scenario when radioactive waste remains on site.
Air				
Clean Air Act (42 USC, ch 85, §§ 7401-7671				
NAAQS: Primary and secondary standards for ambient air quality to protect public health and welfare (including standards for particulate matter and lead).	Contamination of air affecting public health and welfare	40 CFR 0.4-50.12	Not an ARAR	Not enforceable and therefore not an ARAR.
Resource Conservation and Recovery Act Emissions Requirements (42 USC, ch. 82, §§ 6901–6991[i])				
Air emission standards for process vents or equipment leaks.	Equipment that contains or contacts hazardous waste with organic concentrations of at least 10 percent by weight or process vents	CCR tit. 22 § 66264.1030-66264.1034, excluding 1030(c), 1033(j), 1034(c)(2),	Not an ARAR	Not an ARAR since this regulation does not cover radiological constituents of concern.

POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
	associated with specified operations that manage hazardous wastes with organic concentrations of at least 10 ppmw	1034(d)(2) CCR tit. 22 § 66264.1050-66264.1063, excluding 10509c), (d), 1057(g)(2), 1060,163(d)93)		
NESHAPs under CAA that Apply to Radionuclides				
Emissions of radionuclides into the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/y.	Facility owned or operated by the Department of Energy that emits any radionuclide other than ^{222}radon and ^{220}radon into the air	40 CFR Part 61 Subpart H, §61.92	Relevant and appropriate	Not applicable because Parcel B is not a Department of Energy site but may be relevant and appropriate if there is the potential for airborne emissions of radionuclides other than radon. Only an ARAR until cleanup action is completed. Not an ARAR for residual contamination after cleanup.
Emissions of radionuclides, including iodine, into the ambient air from a facility regulated under this subpart shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/y. Emissions of iodine into the ambient air from a facility regulated under this subpart shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 3 mrem/y.	Facilities owned or operated by any federal agency other than the Department of Energy and not licensed by the NRC	40 CFR Part 61 Subpart I § 61.102	Applicable	The requirements are applicable since fugitive dust may be generated during implementation of remedial action at Parcel B. The exposure to the public due to remedial action operations at Parcel B is not likely to exceed 10 mrem/y because of the following reasons: 1) The concentrations of any radionuclide in dust are relatively low as previously measured in air samples, and 2) The concentration of any radionuclide in dust will be reduced

POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
				by use of engineering controls such as wetting of soils.
Surface Water				
Concentration limits for liquid effluent from facilities that extract and process uranium, radium, and vanadium ores: ^{226}Radium (dissolved) 10.0 pCi/L maximum per day 3.0 pCi/L average 30 days ^{226}Radium (total) 30.0 p/Ci/L maximum per day 10.0 p/Ci/L average 30 days Uranium 4.0 mg/L maximum per day 2.0 mg/L average 30 days	Discharges to surface water from certain kinds of mines and mills	40 CFR, Part 440, Subpart C, Parts 440.30–440.35	Not an ARAR	Not an ARAR because discharge to surface water is not a proposed action and Parcel B is not a mine or mill.
Uranium Mill Tailings Radiation Control Act (42 USC, Chapter 88, §§ 192.02, 192.12(a,b), 192.42)[b]				
Control of residual radioactive materials shall be designed to: Be effective for up to 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years, and, Provide reasonable assurance that releases of ^{222}radon from residual radioactive material to the atmosphere will not: (1) Exceed an average release rate of 20 picocuries per square meter per second. This average shall apply over the entire surface of the disposal site and over at least a 1-year period. Radon will come from both residual radioactive materials and from materials covering them. Radon emissions from the covering materials should be estimated as part of developing a remedial action plan for each site. The standard, however,	Inactive uranium processing sites (radioactivity above 5 pCi/g)	40 CFR, Parts 192.02(a),(b)	Not an ARAR	Not applicable since Parcel B was not a uranium processing site. Potentially relevant and appropriate for sites where there is a potential for residual radium, uranium or thorium to release ^{220}radon or ^{222}radon. There is residual radium but not at the levels to meet the requirement.

POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation [a]	ARAR Determination	Comments
applies only to emissions from residual radioactive materials to the atmosphere. Or, (2) Increase the annual average concentration of ^{222}radon in air at or above any location outside the disposal site by more than 0.5 pCi/L.				

Notes:

[a] Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables.

[b] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the statutes or policies in their entirety as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs.

§ – section
ALARA – as low as reasonable achievable
ARAR – applicable or relevant and appropriate requirement
CAA – Clean Air Act
CCR – California Code of Regulations
CFR – Code of Federal Regulations
ch – chapter
cm – centimeter
DON – Department of the Navy
FS – Final Survey
IC – institutional control
LLRW – low-level radioactive waste
mrem/y – millirem per year
NAAQS – National Ambient Air Quality Standards
NESHAPS – National Emissions Standards for Hazardous Air Pollutants
NRC – Nuclear Regulatory Commission
PCB – polychlorinated biphenyl
pCi/g – picocurie per gram
pCi/L – picocurie per liter
ppm – parts per million
RCRA – Resource Conservation and Recovery Act
TCLP – Toxicity Characteristic Leaching Procedure
TEDE – total effective dose equivalent
tit. – title
TMSRA – Technical Memorandum in Support of a Record of Decision Amendment
UMTRCA – Uranium Mill Tailings Radiation Control Act
USC – United States Code
WL – working level

TABLE C.2-2

POTENTIAL STATE CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
State Water Resources Control Board and Regional Water Quality Control Boards [b]				
Requires the operator of a landfill to ensure that the concentration of methane gas migrating from a landfill does not exceed 5 percent by volume in air at the facility property boundary and that the concentration of methane gas does not exceed 1.25 percent by volume in air in any on-site structures during closure and post-closure of the landfill.	Landfill	Cal. Code Regs. tit. 27, § 20921(a)(1) and (2)	Not an ARAR	There is no landfill at Parcel B.
The average concentration of beta particle activity and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year.	Groundwater	Cal. Code Regs. tit. 22, § 64443(a)	Not an ARAR	Not more stringent than federal MCLs at 40 CFR §141.66.
Compliance with this requirement is assumed if the average concentration of gross beta particle activity is less than 50 pCi/L and if the average concentration of tritium and strontium-90 are less than those listed on Table 4.	Groundwater	Cal. Code Regs. tit. 22, § 64443(b)	Not an ARAR	Not more stringent than federal MCLs at 40 CFR §141.66.
If the gross beta particle activity exceeds 50 pCi/L, an analysis of the sample shall be performed to identify the major radioactive constituent present and the appropriate organ and total body doses shall be calculated. Radionuclide concentrations for waters designated as domestic or municipal supply. • Combined ^{226}radium and ^{228}radium – 5 pCi/L • Gross Alpha particle activity (including ^{226}radium, but excluding radon and uranium) – 15 pCi/L • Tritium – 20,000 pCi/L • ^{90}Strontium – 8 pCi/L • Gross Beta particle activity – 50 pCi/L • Uranium – 20 pCi/L	Groundwater	Cal. Code Regs. tit. 22, § 64443(c)	Not an ARAR	Not more stringent than federal MCLs at 40 CFR §141.66.

TABLE C.2-2

POTENTIAL STATE CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Cal/EPA Department of Toxic Substances Control				
Defines "non-RCRA hazardous waste"	Waste	CCR tit. 22 § 66261.22(a)(3) and (4), § 66261.24(a)(2)-(a)(8), § 66261.101, § 66261.3(a)(2)(C), and § 66261.3(a)(2)(F)	Applicable	Applicable for determining whether a waste is or is not RCRA-hazardous waste. These requirements are already identified in the TMSRA (SulTech, 2006).
Establishes concentration limits for cleanup actions, including groundwater, surface water, and the unsaturated zones for other than hazardous waste at background. Allows a higher cleanup limit (but not to exceed MCLs) if background is not technically or economically achievable.		CCR tit.27 §§ 20380(a); 20400 (a), (d), (e), and (g) ; and 20405	Not an ARAR	Not more stringent than federal regulations at CCR tit. 22 § 66264.94.
Establishes concentration limits for cleanup action, including groundwater, surface water, and the unsaturated zones for other than hazardous waste at background. Allows a higher cleanup limit (but not to exceed MCLs) if background is not technically or economically achievable.		CCR tit.27 § 120400	Not an ARAR	Not more stringent than federal regulations at CCR tit. 22 § 66264.94.
Definitions of designated waste, nonhazardous waste, and inert waste.		CCR tit. 27 §§ 20210, 20220, and 20230	Applicable	Potential ARARs for classifying waste and determining ARAR status of other requirements. These requirements are already identified in the TMSRA (SulTech, 2006).

TABLE C.2-2

POTENTIAL STATE CHEMICAL-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
California Department of Health Services [b]				
Standards for protection from radiation. This regulation incorporates 10 CFR, §§ 20.1001 – 20.2402 and Appendices A – G by reference.		CCR tit 17 § 30253	Not an ARAR	The State requirements are not more stringent than federal ARARs, and hence could not be potential ARARs even if they had been identified by the State as State ARARs.

Notes:

[a] Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables.

[b] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the statutes or policies in their entirety as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs.

§ – section
ARAR – applicable or relevant and appropriate requirement
CCR – California Code of Regulations
CFR – Code of Federal Regulations
DON – Department of the Navy
MCL – maximum contaminant level
pCi/L – picocurie per liter
RCRA – Resource Conservation and Recovery Act
tit. – title
TMSRA – Technical Memorandum in Support of a Record of Decision Amendment

TABLE C.3-1

POTENTIAL FEDERAL LOCATION-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Clean Water Act of 1977, as Amended, § 404 (33 USC § 1344) [b]				
Action to minimize the destruction, loss, or degradation of wetlands.	Wetland meeting definition of Section 7	40 CFR § 6.302(a)	Relevant and appropriate	Construction of the shoreline revetment will result in filling of a small (1,300 ft^2) wetland. This requirement is already identified in the TMSRA (SulTech, 2006)
National Historic Preservation Act of 1966, as Amended (Title 16 USC §§ 470-470x-6)[b]				
Action to preserve historic properties; planning of action to minimize harm to properties listed on or eligible for listing on the national Register of Historic Places.	Properties included in or eligible for the national Register of Historic Places	16 USC §§ 470-470x-6, 36 CFR Part 800, and 40 CFR Part 6.301(b)	Applicable	The DON has determined that Building 140 and Discharge Channel are eligible for inclusion on the National Register of Historic Places. The DON is in compliance with this ARAR because none of the remedial alternatives evaluated in this TMSRA Addendum include activities that will have an impact on the building structure.
CZMA (Title 16 USC §§ 1451-1464)[b]				
Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone, including lands thereunder and adjacent shore land	16 USC § 1456(c) and 15 CFR § 930	Relevant and appropriate	The CZMA excludes federal lands from the coastal zone; however, since portions of Parcel B are within the coastal zone, the DON has determined that it is relevant and appropriate.

TABLE C.3-1

POTENTIAL FEDERAL LOCATION-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
State Location-Specific Applicable or Relevant and Appropriate Requirements				
McAteer-Petris Act (California Government Code §§ 66600 through 66661) [b]				
Reduce fill and disposal of dredged material in San Francisco Bay, maintain marshes and mudflats to the fullest extent possible to conserve wildlife, abate pollution, and protect the beneficial uses of the Bay.	Activities affecting San Francisco Bay and 100 feet landward of the shoreline	San Francisco Bay Plan at CCR title 14 §§ 10110 through 11990	Relevant and appropriate	The San Francisco Bay Plan is an approved state coastal zone management program, and the DON will continue to conduct its response actions in accordance with the goals of the San Francisco Bay Plan.
Reduce fill and disposal of dredged material in San Francisco Bay.	Activities affecting San Francisco Bay and 100 feet landward of the shoreline	California Government Code §§ 66600 – 66661.	Relevant and appropriate	The San Francisco Bay Plan is an approved state coastal zone management program, and the DON will continue to conduct its response actions in accordance with the goals of the San Francisco Bay Plan.

Notes:

[a] Only the substantive provisions of the requirements cited in this table are potential ARARs.

[b] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the statutes or policies in their entirety as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs.

§ – section
ARAR – applicable or relevant and appropriate requirement
CCR – California Code of Regulations
CFR – Code of Federal Regulations
CZMA – Coastal Zone Management Act
DON – Department of the Navy
ft^2 – square feet
TMSRA – Technical Memorandum in Support of a Record of Decision Amendment
USC – United States Code

TABLE C.4-1

POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

The alternatives for this feasibility study are: S-1-No Action; S-2-Institutional Controls; S-3-Excavation, Disposal, and Institutional Controls; S-4-Covers, and Institutional Controls; S-5-Excavate, Disposal, Covers, and Institutional Controls; B-1-No Action; and B-2-Survey, Decontaminate, Disposal, and Release

				ARAR Determination			
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Resource Conservation and Recovery Act (42 USC §§ 6901–6991[i])*							
On-site waste generation	Person who generates waste shall determine if that waste is a hazardous waste.	Generator of waste	Cal. Code Regs. tit. 22, § 66262.10(a), 66262.11				Not an ARAR since Parcel B radiological waste has been determined to not be RCRA-hazardous waste.
	Requirements for analyzing on-site waste for determining whether waste is hazardous.	Generator of waste	CCR tit. 22 § 66264.13(a) and (b)				Not an ARAR since Parcel B radiological waste has been determined to not be RCRA-hazardous waste.
Hazardous waste accumulation	On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers in accordance with § 66262.171–178 or in tanks, on drip pads, inside buildings, and is labeled and dated, etc.	Accumulate hazardous waste	CCR tit. 22 § 66262.34				Not an ARAR since Parcel B radiological waste has been determined to not be RCRA-hazardous waste.
Site closure	Minimize the need for further maintenance controls and minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall or runoff, or waste decomposition products to groundwater or surface water or to the atmosphere.	Hazardous waste management facility	CCR tit. 22 § 66264.111(a) and (b)				Not an ARAR since Parcel B radiological waste has been determined to not be RCRA-hazardous waste.

TABLE C.4-1

POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

The alternatives for this feasibility study are: S-1-No Action; S-2-Institutional Controls; S-3-Excavation, Disposal, and Institutional Controls; S-4-Covers, and Institutional Controls; S-5-Excavate, Disposal, Covers, and Institutional Controls; B-1-No Action; and B-2-Survey, Decontaminate, Disposal, and Release

				ARAR Determination			
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Container storage	Storage containers of RCRA-hazardous waste must be – maintained in good condition – compatible with hazardous waste to be stored, and closed during storage except to add or remove waste	Storage of RCRA-hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere, in a container	CCR tit. 22 § 66264.171, 172, and 173				Not an ARAR since Parcel B radiological waste has been determined to not be RCRA-hazardous waste.
	Inspect storage container storage areas weekly for deterioration.		CCR tit. 22 § 66264.174				Not an ARAR since Parcel B radiological waste has been determined to not be RCRA-hazardous waste.
	Place storage containers on a sloped, free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaded waste in a timely manner to prevent overflow of the containment system.		CCR tit. 22 § 66264.175(a) and (b)				Not an ARAR since Parcel B radiological waste has been determined to not be RCRA-hazardous waste.
	At closure, remove all hazardous waste and residues form the containment system, and decontaminate or remove all containers and liners.		CCR tit. 22 § 66264.178				Not an ARAR since Parcel B radiological waste has been determined to not be RCRA-hazardous waste.

TABLE C.4-1

POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC ARARs FOR HUNTERS POINT SHIPYARD PARCEL B

The alternatives for this feasibility study are: S-1-No Action; S-2-Institutional Controls; S-3-Excavation, Disposal, and Institutional Controls; S-4-Covers, and Institutional Controls; S-5-Excavate, Disposal, Covers, and Institutional Controls; B-1-No Action; and B-2-Survey, Decontaminate, Disposal, and Release

				ARAR Determination			
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Waste pile	Allows generator to accumulate solid remediation waste in an EPA-designated pile for storage only, up to 2 years, during remedial operations without triggering land disposal restrictions.	Hazardous remediation waste temporarily stored in piles	40 CFR § 264.554(d)(1) (i-ii) and (d)(2), (e), (f), (h), (i), (j), and (k)				Not an ARAR since Parcel B radiological waste has been determined to not be RCRA-hazardous waste.

Notes:

[a] Only the substantive provisions of the requirements cited in this table are potential ARARs.

§ – section
A – applicable
ARAR – applicable or relevant and appropriate requirement
CCR – California Code of Regulations
CFR – Code of Federal Regulations
EPA – U.S. Environmental Protection Agency
RA – relevant and appropriate
RCRA – Resource Conservation and Recovery Act
TBC – to be considered
tit. – title
USC – United States Code

APPENDIX D

RESPONSE TO COMMENTS RECEIVED ON THE DRAFT FINAL PARCEL B TMSRA RADIOLOGICAL ADDENDUM

RESPONSE TO COMMENTS FOR
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM
IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM
DATED: SEPTEMBER 25, 2007
PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
DCN: ECSD-2201-0006-0074

Reviewed by U.S. Environmental Protection Agency
Comments Dated: October 26, 2007

GENERAL COMMENTS	RESPONSE
Comment 1. Fill Areas: Since licensing and LUCs are currently topics being debated for IR sites 07/18, the TMSRA RA should provide as much information as possible about these sites. The summary of the HRA is insufficient, because it lists everything that might have been disposed of from base operations, not what might have actually gone into these sites. Also, quoting the CERCLA permit exemption in the response to comments is not sufficient because CADPH has raised valid questions. Please provide site specific information from previous soil excavations and lay out a process for acquiring information to support the Navy's contention that LUCs implemented through the ROD are protective. This is the document that supports the final decision, so please provide sufficient information on which to base a decision.	**Response 1.** The Historical Radiological Assessment (HRA) includes a summary assessment of radiological site conditions, recommendations for future site-specific radiological investigations, and extensive reference materials for IR-07/18. Although these areas were filled with shipyard debris and soil in the 1950s to establish a support area for Dry Docks 5, 6 and 7, IR-07/18 are not considered a municipal or military landfill. Despite the lack of documentation, the general timeline of land expansion can be inferred by interpretation of aerial photographs. The photograph included as Attachment 1 to these RTCs indicates that the construction of IR-07/18 occurred after 1951 which is nearly 5 years after OPERATIONS CROSSROADS testing was completed. The results of site-specific investigations conducted at IR-07/18 are presented in Section 6 and, by reference in Appendix D of the HRA. Specific references by number which are included in Appendix D of the HRA are 593 (Phase I Investigation), 2946 (DHS comments on NORM Report), 2953 (EPA Petrographic

Reviewed by U.S. Environmental Protection Agency
Comments Dated: October 26, 2007

	Analysis Report), 2991 (NORM at IR07/18 Report), and 2993 (Phase II Investigation Report). The Navy intends to propose a containment remedy for IR Sites 7 and 18 in a Draft Proposed Plan to be submitted to the FFA Signatories. The proposed containment remedy complies with the remedy selection provisions of the NCP at 40 CFR Part 300 as required by CERCLA including the "protectiveness" and "long term effectiveness and permanence" requirements of Sections 300.430(e) and (f). The proposed containment remedy consists of a radiological surface survey, identification and removal of radionuclides above the remediation goals (RGs), an engineered soil cap protected by institutional controls ("ICs"), and is based upon the remedial alternatives set forth in the Parcel B TMSRA (Alternatives S4 and S5) and TMSRA RA (Alternatives R2 and R3). The RGs are consistent with and generally more stringent than USEPA policy for establishing cleanup levels for radionuclides ("Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination", USEPA OSWER Directive 9200.4-18 (August 22, 1997)). Development,

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by U.S. Environmental Protection Agency Comments Dated: October 26, 2007	
	implementation, oversight, and enforcement of the proposed ICs will preserve the integrity of the cap to ensure continuous and permanent prevention of exposure and risk. The Navy believes that violations of the proposed ICs are unlikely because of the layered oversight and enforcement mechanisms that would be put in-place as described above. Furthermore, the possibility of significant exposure to radiation occurring before a violation of an IC is detected during an annual inspection and subsequently corrected is very remote. Quantifying exposure based upon worst case assumptions is inconsistent with CERCLA and the NCP. A detailed description of the proposed containment remedy, the associated land-use controls, and applicable federal regulations is included as Attachment 2 to these RTCs. The Final TMSRA-RA has been modified to incorporate changes as described above.
SPECIFIC COMMENTS	**RESPONSE**
Comment 2. Page ES-2. The purpose of the table should be to list planned reuse for the IR sites and buildings, but instead it lists	**Response 2.** The specific reuse of individual radiologically impacted sites is based on the existing planning materials from the

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by U.S. Environmental Protection Agency Comments Dated: October 26, 2007	
planned reuse and exposure scenario for any redevelopment block touched by the site or building. Please change the planned reuse and exposure scenario columns to include only those uses and exposures at the specific IR site.	City of San Francisco redevelopment plan. Therefore, the planned reuse of each underlying and adjacent redevelopment block was used as the basis for determining the most appropriate exposure scenario for the radiologically impacted sites listed in the table. Table ES-2 has been revised to accurately reflect the intended purpose identified in the corresponding column. Residential scenarios were used for evaluating dose and risk. This table reflects the reuse classification as identified in the City of San Francisco's redevelopment plan, and not the exposure scenario for modeling purposes. While the future development plan may change, the City has confirmed an open space reuse will continue for IR-07/18.
Comment 3. Chapter 3, Risk Assessment Presentation. CERCLA risk assessments are always presented based on current conditions, to assess the existing risk and to justify an action. This document presents calculated risks for conditions after cleanup goals are achieved. This is mentioned in the second paragraph of Section 3.5, but should be made clear in the beginning of the chapter. Please add an explanation at the	**Response 3.** The following verbiage has been inserted beginning at the second sentence of Section 3.0: "Currently, there is very little data available to accurately and appropriately assess current risk at each radiologically impacted site. At each radiologically impacted building or site, excluding IR-07/18, a combination of scoping, remedial action, and final status surveys, based on MARSSIM methodology, will permit a dynamic approach, where

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by U.S. Environmental Protection Agency Comments Dated: October 26, 2007	
beginning of Chapter 3 that insufficient data exists for calculating current risk, discuss how data will be collected and how that will be used to guide cleanup decisions.	the results of field investigations are used to define and refine the direction of field work and guide cleanup decisions. At IR-07/18, The proposed containment remedy complies with the remedy selection provisions of the NCP at 40 CFR Part 300 as required by CERCLA including the "protectiveness" and "long term effectiveness and permanence" requirements of Sections 300.430(e) and (f)."
Comment 4. Section 5.1.3. The alternatives description for Sites IR 07 and 18 should include the soil cover to be installed.	**Response 4.** Section 5.1.3 has been revised to include a description of the soil cover to be installed following the proposed surface survey and hot spot removal to 12 inches below ground surface. Specifically, the soil cover comprises an engineering control consisting of a two-foot-thick layer of clean soil ("soil cap") placed on top of a demarcation layer (durable fence mesh demarking the bottom of the two foot soil cap). The proposed soil cover will effectively reduce the dose and residual risk associated with ROCs at the release criteria at and below the original surface to the levels described in the remedial action objectives.
Comment 5. Section 5.3. This document presents no data for radiological constituents in groundwater, but references the	**Response 5.** Radiological groundwater data for Parcel B has not been collected. Groundwater monitoring for radiological

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by U.S. Environmental Protection Agency Comments Dated: October 26, 2007	
TMSRA for groundwater remedial alternatives. Since the TMSRA also contains no discussion of radiological constituents in groundwater, please include a summary of such data here.	constituents will begin in the first quarter of 2008. The results of groundwater monitoring for radiological components will be used to refine the sampling program. A discussion of the planned radiological groundwater sampling has been included as part of the remedial alternative descriptions.

RESPONSE TO COMMENTS FOR
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM
IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM
DATED: SEPTEMBER 25, 2007
PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
DCN: ECSD-2201-0006-0074

Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH)
Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC)
Robin R. Hook, Environmental Management Branch (CDPH)
Comments Dated: October 31, 2007

GENERAL COMMENTS	RESPONSE
Comment 1. Response to Comment #3: EMB does not concur with the Navy that the surface scans can adequately characterize the fill areas and the residual from the surface surveys should be used for assessment of annual radiation dose and risk. As per NUREG 5849, "If there is potential for residual activity below the surface layer, the survey plan should include subsurface sampling". EMB recommends using subsurface activity data for calculating the annual radiation dose and increased cancer risk for all exposure pathways such as ingestion of food pathway and drinking water pathway. Please demonstrate with RESRAD or any other dose modeling algorithm using subsurface activity data that capping will reduce the risk to 10^{-6} for all relevant exposure pathways for the two fill areas.	**Response 1.** The Navy does not contend that surface scans will fully characterize the Fill Areas 7 and 18 The exposure pathways for evaluation were developed in consultation with the BCT and are presented in Appendix A of the Final TMSRA. The pathways included for evaluation are those that have been determined to be viable in both the current and future reuse scenarios for the sites. The drinking water pathway was included due to its inclusion in the risk analysis in the Final TMSRA. Because the primary pathway of exposure is external radiation, dose modeling utilizing subsurface activity data would have minimal affect due to the shielding afforded by the proposed soil cover. Additionally, the HRA identifies the potential for radiological contamination at IR-07/18 as "unlikely", and this determination is supported by the findings of previous investigations included in Appendix D of the HRA and described

Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH)
Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC)
Robin R. Hook, Environmental Management Branch (CDPH)
Comments Dated: October 31, 2007

	in Response to EPA General Comment 1. Given the speculative nature of potential risk, quantified risk assessment is unnecessary and inappropriate. Please see Section 3a of Attachment 2. The Navy intends to propose a containment remedy for IR Sites 7 and 18 in a Draft Proposed Plan to be submitted to the FFA Signatories. The proposed containment remedy complies with the remedy selection provisions of the NCP at 40 CFR Part 300 as required by CERCLA including the "protectiveness" and "long term effectiveness and permanence" requirements of Sections 300.430(e) and (f). The proposed containment remedy consists of a radiological surface survey, identification and removal of radionuclides above the remediation goals (RGs), an engineered soil cap protected by institutional controls ("ICs"), and is based upon the remedial alternatives set forth in the Parcel B TMSRA (Alternatives S4 and S5) and TMSRA RA (Alternatives R2 and R3). The RGs are consistent with and generally more stringent than USEPA policy for establishing cleanup levels for

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH) Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC) Robin R. Hook, Environmental Management Branch (CDPH) Comments Dated: October 31, 2007	
	radionuclides ("Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination", USEPA OSWER Directive 9200.4-18 (August 22, 1997)).Development, implementation, oversight, and enforcement of the proposed ICs will preserve the integrity of the cap to ensure continuous and permanent prevention of exposure and risk. The Navy believes that violations of the proposed ICs are unlikely because of the layered oversight and enforcement mechanisms that would be put in-place as described above. Furthermore, the possibility of significant exposure to radiation occurring before a violation of an IC is detected during an annual inspection and subsequently corrected is very remote. Quantifying exposure based upon worst case assumptions is inconsistent with CERCLA and the NCP. A detailed description of the proposed containment remedy, the associated land-use controls, and applicable federal regulations is included as Attachment 2 to these RTCs. Therefore, additional characterization of the subsurface materials is not considered

RESPONSE TO COMMENTS FOR
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM
IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM
DATED: SEPTEMBER 25, 2007
PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
DCN: ECSD-2201-0006-0074

Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH)
Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC)
Robin R. Hook, Environmental Management Branch (CDPH)
Comments Dated: October 31, 2007

	necessary.
Comment 2. Any contamination found by the surface scans confirms that the fill area is contaminated; however, not detecting any contamination via surface scans does not confirm that subsurface contamination doesn't exist. The radioactivity found by surface scan should not be used to calculate the annual radiation dose and increased cancer risk to the public for the burial sites, instead subsurface activity data should be used for these calculations. We cannot concur with a restricted release at this time. Note that, per 10CFR Part 20.1403 (e) for a restricted release the licensee needs to show that residual radioactivity at the site has been reduced so that if the institutional controls were no longer in effect, there is reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group is as low as reasonably achievable and would not exceed either— (1) 100 mrem (1 mSv) per year; or	**Response 2.** Please see response to EPA General Comment number 1. The Navy agrees there is a remote potential for subsurface radiological contamination at IR-07/18, and does not intend to seek free release based on the results of a surface scan. The potential inclusion and applicability of subsurface data is discussed in Response to EMB General Comment 1. The Navy intends to propose a containment remedy for IR Sites 7 and 18 in a Draft Proposed Plan to be submitted to the FFA Signatories. The proposed containment remedy complies with the remedy selection provisions of the NCP at 40 CFR Part 300 as required by CERCLA including the "protectiveness" and "long term effectiveness and permanence" requirements of Sections 300.430(e) and (f). The proposed containment remedy consists of a radiological surface survey, identification and removal of radionuclides above the remediation goals (RGs), an engineered soil cap protected by institutional controls ("ICs"), and is based

RESPONSE TO COMMENTS FOR
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM
IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM
DATED: SEPTEMBER 25, 2007
PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
DCN: ECSD-2201-0006-0074

Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH)
Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC)
Robin R. Hook, Environmental Management Branch (CDPH)
Comments Dated: October 31, 2007

(2) 500 mrem (4 mSv) per year provided the licensee- (i) Demonstrates that further reductions in residual radioactivity necessary to comply with the 100 mrem/y (1 mSv/y) value of paragraph (e)(1) of this section are not technically achievable, would be prohibitively expensive, or would result in net public or environmental harm; (ii) Makes provisions for durable institutional controls; (iii) Provides sufficient financial assurance to enable a responsible government entity or independent third party, including a governmental custodian of a site, both to carry out periodic rechecks of the site no less frequently than every 5 years to assure that the institutional controls remain in place as necessary to meet the criteria of §20.1403(b)	upon the remedial alternatives set forth in the Parcel B TMSRA (Alternatives S4 and S5) and TMSRA RA (Alternatives R2 and R3). The RGs are consistent with and generally more stringent than USEPA policy for establishing cleanup levels for radionuclides ("Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination", USEPA OSWER Directive 9200.4-18 (August 22, 1997)). Development, implementation, oversight, and enforcement of the proposed ICs will preserve the integrity of the cap to ensure continuous and permanent prevention of exposure and risk. The Navy believes that violations of the proposed ICs are unlikely because of the layered oversight and enforcement mechanisms that would be put in-place as described above. Furthermore, the possibility of significant exposure to radiation occurring before a violation of an IC is detected during an annual inspection and subsequently corrected is very remote. ICs will remain in effect as long as necessary to protect human health and the environment as required by

RESPONSE TO COMMENTS FOR
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM
IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM
DATED: SEPTEMBER 25, 2007
PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
DCN: ECSD-2201-0006-0074

Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH)
Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC)
Robin R. Hook, Environmental Management Branch (CDPH)
Comments Dated: October 31, 2007

and to assume and carry out responsibilities for any necessary control and maintenance of those controls. Acceptable financial assurance mechanisms are those in paragraph (c) of this section. EMB suggests that if that Navy requests restricted release, it should use subsurface data activity to perform dose modeling to demonstrate that in case of IC failure the above regulation is met.	CERCLA and the NCP (Attachment 2, Section 2). Further, the proposed remediation goals and remedial action for Parcel B are protective of human health and the environment and are more stringent and protective than the 100 and 500 millirem per year "dose cap" criteria in 10 CFR Section 20.1403(e). Therefore, the requirements of 10 CFR Section 20.1403(e) have not been carried forward for further analysis as a potential CERCLA federal "applicable or relevant and appropriate requirement" ("ARAR"). A detailed description of the proposed containment remedy, the associated land-use controls, and applicable federal regulations is included as Attachment 2 to these RTCs.
Comment 3. Response to Comment #9c. CDPH understands that it has no authority to require the Navy to obtain a radioactive material license from the State for the CERCLA remediation of the radionuclides at Hunters Point. However, in accordance with the California Health and Safety Code and the California Code of	**Response 3.** The Historical Radiological Assessment (HRA) includes a summary assessment of radiological site conditions, recommendations for future site-specific radiological investigations, and extensive reference materials for IR-07/18. Although these areas were filled with shipyard debris and soil after

RESPONSE TO COMMENTS FOR
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM
IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM
DATED: SEPTEMBER 25, 2007
PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
DCN: ECSD-2201-0006-0074

Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH)
Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC)
Robin R. Hook, Environmental Management Branch (CDPH)
Comments Dated: October 31, 2007

Regulations, CDPH has the authority to request the entity to whom the Navy transfers the site to obtain a radioactive materials license when it has not been demonstrated that a reduction of the level of contamination from radioactive materials has been accomplished to the level that is reasonably necessary to eliminate the hazards to public health. The Navy has not provided sufficient information to conclude that this requirement has been met or for EMB to concur that the site is acceptable for unrestricted release. Based on information from the Navy, very few samples have been analyzed and insufficient trenching has been done to characterize Fill Areas 7 and 18. Additionally, the history of what radiological wastes may have been put into these fill areas is very limited. Therefore, EMB requests that additional characterization be preformed on the fill areas to provide a better understanding of the magnitude of radiological wastes that may be in these fill areas. Also, any additional historical information on disposal	1951 to establish a support area for Dry Docks 5, 6 and 7, IR-07/18 are not considered a municipal or military landfill. Despite the lack of documentation, the general timeline of land expansion can be inferred by interpretation of aerial photographs. The photograph included as Attachment 1 to these RTCs indicates that the construction of IR-07/18 occurred after 1951 which is nearly 5 years after OPERATIONS CROSSROADS testing was completed. The Navy intends to propose a containment remedy for IR Sites 7 and 18 in a Draft Proposed Plan to be submitted to the FFA Signatories. The proposed containment remedy complies with the remedy selection provisions of the NCP at 40 CFR Part 300 as required by CERCLA including the "protectiveness" and "long term effectiveness and permanence" requirements of Sections 300.430(e) and (f). The proposed containment remedy consists of a radiological surface survey, identification and removal of radionuclides above the remediation goals (RGs), an engineered soil cap protected by institutional controls ("ICs"), and is based

RESPONSE TO COMMENTS FOR
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM
IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM
DATED: SEPTEMBER 25, 2007
PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
DCN: ECSD-2201-0006-0074

Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH)
Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC)
Robin R. Hook, Environmental Management Branch (CDPH)
Comments Dated: October 31, 2007

practices at the Hunters Point Shipyard should be provided so EMB may make a reasonable estimate of total radiological waste present. EMB recommends that if the Navy believes that the fill material on this site can't be adequately characterized, due to cost or other reasons, then the fill material should be removed, thus allowing unrestricted release f the parcel. Also, while CDPH believes it has authority to require a license from the entity to whom the site is transferred, it cannot at this time determine whether a license would necessarily provide the level of health and safety protection required by law.	upon the remedial alternatives set forth in the Parcel B TMSRA (Alternatives S4 and S5) and TMSRA RA (Alternatives R2 and R3). The RGs are consistent with and generally more stringent than USEPA policy for establishing cleanup levels for radionuclides ("Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination", USEPA OSWER Directive 9200.4-18 (August 22, 1997)). Development, implementation, oversight, and enforcement of the proposed ICs will preserve the integrity of the cap to ensure continuous and permanent prevention of exposure and risk. The Navy believes that violations of the proposed ICs are unlikely because of the layered oversight and enforcement mechanisms that would be put in-place as described above. Furthermore, the possibility of significant exposure to radiation occurring before a violation of an IC is detected during an annual inspection and subsequently corrected is very remote. Quantifying exposure based upon worst case assumptions is inconsistent with CERCLA and the NCP. A

Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH)
Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC)
Robin R. Hook, Environmental Management Branch (CDPH)
Comments Dated: October 31, 2007

	detailed description of the proposed containment remedy, the associated land-use controls, and applicable federal regulations is included as Attachment 2 to these RTCs. Contrary to the information referenced in the comment, radiological investigations have been performed at IR-07/18, with a summary presented in Response to EPA General Comment 1. The Final TMSRA-RA has been modified to incorporate the description of previous investigations provided that response. The HRA indicated that the contamination potential for IR07 and IR18 is unlikely. Specific documentation suggesting burial of radiologically contaminated material at IR07 or IR18 has not been found. However, there is substantial documentation in Section 6 and Appendix D of the HRA on disposal practices at Hunter's Point Shipyard. As a general principle, the Navy does not agree that permits, licenses, or similar regulatory approvals are required for a CERCLA response action. More specifically, Section 121(e)(1) of

RESPONSE TO COMMENTS FOR
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM
IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM
DATED: SEPTEMBER 25, 2007
PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
DCN: ECSD-2201-0006-0074

Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH)
Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC)
Robin R. Hook, Environmental Management Branch (CDPH)
Comments Dated: October 31, 2007

	CERCLA states that "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." CERCLA requires that CERCLA decision documents address cleanup standards that would otherwise be addressed in such permits, licenses, etc. The Navy understands that one of DHS' underlying concerns relating to the licensing issue is that the long-term reliability of deed restrictions has not been proven. The State of California has already resolved this concern with the Navy in an agreement reached at the conclusion of intensive negotiations in 1999 and 2000. More specifically, the California Department of Toxic Substances Control and the Navy entered into a "Memorandum of Agreement Between the United States Department of Navy and the California Department of Toxic Substances Control, Use of Model 'Covenant to Restrict Use of Property' at Installations being Closed and Transferred by the

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH) Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC) Robin R. Hook, Environmental Management Branch (CDPH) Comments Dated: October 31, 2007	
	United States Department of Navy" (hereinafter the "MOA") on March 10, 2000. The Navy and DTSC jointly endorsed the use of covenants to restrict the use of property as components of CERCLA remedies in this MOA. The Navy intends to abide by this MOA as set forth in the TMSRA and TMSRA RA reports and this will prevent public exposure to any residual radioactive materials that may be encapsulated in any containment remedy selected for the sites. Furthermore, both Navy policy and DTSC regulations require that an implementation plan be developed and executed providing for the long-term monitoring and enforcement of compliance with covenants to restrict the use of property. The Navy, therefore, does not agree with the comment provided by CDPH. The Navy does not intend to pursue a DHS license for the CERCLA remediation of the radionuclides at Hunters Point and requests that DPH agree to refrain from seeking to impose a license upon future Navy transferees.
Comment 4. Response to Comment #8. EMB recognizes that it	**Response 4.** Because of the safety issues associated with the

RESPONSE TO COMMENTS FOR
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM
IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM
DATED: SEPTEMBER 25, 2007
PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
DCN: ECSD-2201-0006-0074

Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH)
Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC)
Robin R. Hook, Environmental Management Branch (CDPH)
Comments Dated: October 31, 2007

may not be possible to conduct radiological surveys in Building 140 shaft below 10 feet due to the associated health and safety hazards but at the same time would like to identify the radiation dose and the associated cancer risk to the public in the event the ICs were compromised. We cannot concur with a restricted release at this time. Note that, as per the regulation 10 CFR Part 20.1403 (e) for a restricted release the licensee needs to show that residual radioactivity distinguishable from background to the average member of the critical group is as low as reasonably achievable and would not exceed either- (1) 100 mrem (1 mSv) per year; or (2) 500 mrem (5 mSv) per year provided the licensee- (i) Demonstrates that further reductions in residual radioactivity necessary to comply with the 100 mrem/y (1 mSv/y) value of paragraph (e)(1) of this section are not technically achievable, would be prohibitively expensive, or would result in net	instability of the shaft that prevent surveys of the shaft, it is Navy's intention to fill in the shaft and leave it in place. Radiological surveys will be conducted in the building and discharge tunnel. This combination is considered the best approach to address the potential contamination pathways and still be protective of human health and the environment. Pertinent information for the site will be provided in the survey reports. This information will include dose and risk assessments for all areas of the site. Free release is not being sought for the deep sections. The function of the TMSRA-RA is to evaluate alternatives that meet all ARARs and are protective of human health and the environment under CERCLA. A detailed description of the proposed containment remedy, the associated land-use controls, and applicable federal regulations is included as Attachment 2 to these RTCs.

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH) Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC) Robin R. Hook, Environmental Management Branch (CDPH) Comments Dated: October 31, 2007	
public or environmental harm; (ii) Makes provisions for durable institutional controls; (iii) Provides sufficient financial assurance to enable a responsible government entity or independent third party, including a governmental custodian of a site, both to carry out periodic rechecks of the site no less frequently than every 5 years to assure that the institutional controls remain in place as necessary to meet the criteria of §20.1403(b) and to assume and carry out responsibilities for any necessary control and maintenance of those controls. Acceptable financial assurance mechanisms are those in paragraph (c) of this section.	
Comment 5. Response to Comment #11. The Navy did not clearly respond to our query about former building sites (Building	**Response 5.** Building 157 was surveyed and released as part of the radiological investigation in 2006. All building material was

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH) Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC) Robin R. Hook, Environmental Management Branch (CDPH) Comments Dated: October 31, 2007	
142 and 157). Please clarify if the buildings were remediated prior their demolition. Also, please explain how and where the debris from these buildings was disposed.	surveyed as equipment and materials, and subsequently disposed of as standard construction debris at Ox Mountain Landfill. Additionally, the former building footprint is in the process of being surveyed. As documented in the HRA (Section 8, Page 8-29)), Building 142 was a partially demolished air raid shelter. The Building 142 site had two foundations. The surface foundation was surveyed, released, and removed. Upon removal, a previously unidentified building foundation was discovered. This was also surveyed, released and removed. Additional surveys of the former building footprint have been completed. Records of the building demolition and disposal are not available, although the potential for the presence of radiological contamination is identified as "unlikely" in the HRA. A report of the Building 142 surveys is being prepared.
Comment 6. Referring to Appendix C. We cannot concur with a restricted release at this time. If the Navy intends to request that	**Response 6.** Please see Response to EMB Specific Comment #4, in addition to Attachment 2 to these RTCs.

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH) Thomas P. Lanphar, Senior Hazardous Substances Scientist (DTSC) Robin-R. Hook, Environmental Management Branch (CDPH) Comments Dated: October 31, 2007	
ICs are to be in effect, the EMB would prefer that 10 CFR Part 20.1403 (e) be incorporated as the Federal ARAR for the health and safety of the public.	
SPECIFIC COMMENTS	**RESPONSE**
Comment 1. Response to Comment #3. EMB does not agree with the Navy's response that the cost associated with excavation to depth and disposal of excavated material does not provide additional risk reduction. Please provide documents to justify the cost versus risk reduction.	**Response 1.** Comment noted. The intent in Navy's response was to state that with the surface surveys and removals, and remedy planned for IR-07/18 there would be no risk on the surface of the site versus the risk that would be incurred during the excavation of all the fill materials.

RESPONSE TO COMMENTS FOR
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM
IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM
DATED: SEPTEMBER 25, 2007
PARCEL B, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
DCN: ECSD-2201-0006-0074

Reviewed by San Francisco Health Department and Lennar BVHP,
Comments Dated: October 26, 2007

GENERAL COMMENTS	RESPONSE
Comment 1. Our comments on this document and in particular our comments on the proposed areas requiring institutional controls are all based on the assumption that IR7/18 and the deep sump underneath Building 140 are the only areas that will be determined to be areas requiring institutional controls due to potential suspected residual low-level radionuclides. If there are any other areas that would be subject to restrictions due to radionuclides, it may render those areas undevelopable and therefore we can not accept restrictions for other areas at this time. To this end, we suggest that Figure 2-3 be removed from the document and instead that it be stated that exact dimensions of the areas requiring institutional controls for potential radionuclides in IR 7/18 and under Building 140 will be surveyed to define the legal metes and bounds for inclusion in the property transfer documents.	**Response 1.** Figure 2-3 has been modified to clearly present the areas requiring institutional controls (ARICs) are limited to IR-07/18 and the Building 140 pump shaft below 10 feet. Further precision of the boundaries shall be achieved as the property transfer process progresses via surveying. These surveys shall only serve to refine the boundaries of the sites, and are not expected to result in additional ARICs.
Comment 2. This document does not include the results of Class I surveys already performed on impacted buildings which reportedly indicate unrestricted clearance of the buildings is	**Response 2.** The purpose of this document is to assess alternatives for radiologically impacted sites not to document previous or ongoing radiological investigations. The HRA

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by San Francisco Health Department and Lennar BVHP, Comments Dated: October 26, 2007	
anticipated, nor does the document report the presence or absence of radiological materials encountered in the numerous excavation activities performed on IR 7/18. Additionally, the completion of the Parcel B sewer/storm drain removal activities is not noted. We request that this information be added to the TMSRA RA to provide a more accurate representation of radiological concerns at Parcel B, and to conform to the TMSRA presentation of past investigation results.	provided an analysis, summary and presentation of past radiological investigations, practices and procedures up to the time of publication. The results of previous site-specific investigations, as available, are presented in Appendix D of the HRA. Additionally, a summary of previous investigations is included in Response to EPA General Comment 1. Results of ongoing investigations (Class 1 surveys, sewer removal, etc) are not available for summary at this time, but will be presented in the appropriate post-construction documentation.
Comment 3. We presume that the design of the engineering controls that will be installed on IR7/18 will include sufficient protection so that the demarcation between the restricted soils left in place and the depth of clean fill placed on top of the demarcation will allow the City, the San Francisco Redevelopment Agency or any future property owner to build and maintain the designated reuse (open space) without disturbing restricted soil. We presume that facilities typical to open space areas (irrigation systems, installation of plants, construction of restroom facilities, installation of shallow utilities to service the	**Response 3.** The proposed soil cap will comprise an engineering control consisting of a two-foot-thick layer of clean soil ("soil cap") placed on top of a demarcation layer (durable fence mesh demarking the bottom of the two foot soil cap). Installation of facilities as described in the comment will be subject to those requirements as described in the risk management plan and defined in the land use control remedial design (LUC-RD) as approved by the FFA signatories. It is anticipated that the land use control descriptions included in Attachment 2 will serve as the basis of the LUC-RD.

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by San Francisco Health Department and Lennar BVHP, Comments Dated: October 26, 2007	
restroom facilities) will be allowed to be installed in the clean fill and that no additional approvals will be required unless those approvals and procedures are detailed in the RMP.	
Comment 4. Please provide a more detailed description of materials generated during the decontamination of ships and other decontamination debris referred to in the Executive Summary and Section 2.1.1.	**Response 4.** Descriptions of materials generated during decontamination of ships that participated in atomic weapons testing can be obtained from Section 6 and, by reference, Appendix D of the HRA. A summary of this information is provided in Response to EPA General Comment #1. In addition, the text of Section 2.1.1 has been revised to summarize information from the HRA.
Comment 5. Building 114 is shown as an impacted building, but this building is not included in the text or table discussions of impacted buildings, although Section 1.1 indicates that Building 114 field work and report has been included. Please include 114 discussion, including results, in the TMSRA RA.	**Response 5.** As discussed in Section 1.1 of the TMSRA-RA, field work is complete at Building 114 and is excluded from this evaluation. Building 114 was demolished, and a final status survey (FSS) was conducted at the former Building 114 Site and documentation is pending submittal. Preliminarily, the site has been identified for "unrestricted radiological release", and a request for concurrence will be submitted concurrently with the FSS document.
Comment 6. Based on discussions about Building 140, we	**Response 6.** The above ground structure (10 feet below ground

Reviewed by San Francisco Health Department and Lennar BVHP,
Comments Dated: October 26, 2007

presume that all surfaces and structures above ground will be cleared for radiological contamination so that visitors or tenants in that structure will not be subjected to radiological risk. If this is not correct, then please explain how health and safety will be protected. If health and safety can not be protected then demolishing the building and removal of the potential radiological contamination in the sump should be considered even though the Building is designated as an historic structure. Will the clearance of the building structures be documented in the same manner all other building clearances are documented? We presume that future documents will describe the details of the presumed restriction for the sump under Building 140. In addition, we presume that any restriction for the sump under the building will be at sufficient depth to allow use of the building and installation and maintenance of underground utilities to service the building without any restrictions related to radiological issues.	surface and above) of Building 140 and the discharge tunnel will be surveyed for unrestricted radiological release. As the pump shaft is unstable and considered unsafe for personnel, it will be filled in up to 10 feet bgs and left in place. Site-specific planning documentation shall detail the planned actions to be undertaken as part of the remediation. In addition, the details of the presumed restrictions shall be defined and described in the land use control remedial design (LUC-RD), subject to review and approval by FFA signatories. It is anticipated that the land use control descriptions included in Attachment 2 will serve as the basis of the LUC-RD.
SPECIFIC COMMENTS	**RESPONSE**
Comment 1. Section 2.2 Nature and Mechanism of Release: This section states that sandblast grit was disposed on site after 1946,	**Response 1.** Please see response to EPA General Comment 1 regarding previous investigations, findings, and presence of ABM

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by San Francisco Health Department and Lennar BVHP, Comments Dated: October 26, 2007	
and notes the possibility of the presence of these materials in IR 7/18. In meetings we've heard that sandblast grit is not present on the rest of Parcel B. Can you confirm this and explain why the other areas of Parcel B are not suspected to contain sandblast grit.	in Parcel B. ABM has been encountered at IR-07/18 in the past, and potential exists that more will be present. Other areas of Parcel B are not suspected to contain ABM as the applicable procedures called for controlled onsite disposal of ABM in designated fill areas only.
Comment 2. Table 2-1 and 3-1, and Table on Pg. ES-2: Please change column title from "Planned Reuse" to "Redevelopment Block Planned Reuse" to avoid the implication that the indicated reuse is for specific buildings.	**Response 2.** Table 2-1, 3-1 and the table on page ES-2 column title "Planned Reuse" has been revised to read; "Redevelopment Block Planned Reuse".
Comment 3. Figure 2-3, Parcel B Impacted Sites, Redevelopment Blocks and Intended Reuse: Please differentiate between existing and former buildings. Please illustrate the extent of the discharge tunnel associated with Building 140, and further describe the nature of the tunnel and potential radionuclides materials suspected in the tunnel.	**Response 3.** Figure 2-3 is intended to be an overall summary of impacted sites and redevelopment blocks. Currently, Figure 2-4 illustrates the extent of the discharge tunnel associated with Building 140. It has also been revised to differentiate buildings which have and have not been demolished. The radionuclides of concern at Building 140, and the associated pump shaft and discharge tunnel, are presented in Table 2-1.
Comment 4. Section 4.4.1.2 Institutional Controls. We presume that the Navy will satisfy all CERCLA regulatory	**Response 4.** The Navy intends to propose a containment remedy for IR Sites 7/18 in a Draft Proposed Plan to be submitted to the

Reviewed by San Francisco Health Department and Lennar BVHP,
Comments Dated: October 26, 2007

requirements and any NRC or other state or federal requirements, if needed, in order to gain approval from all appropriate regulators to qualify to place a radionuclide restriction on IR7/18 and the sump beneath Building 140.	FFA Signatories. The proposed containment remedy consists of an engineered soil cap protected by institutional controls ("ICs") and is based upon the remedial alternatives set forth in the Parcel B TMSRA (Alternatives S4 and S5) and TMSRA RA (Alternatives R2 and R3). The proposed containment remedy complies with the remedy selection provisions of the NCP at 40 CFR Part 300 as required by CERCLA including the "protectiveness" and "long term effectiveness and permanence" requirements of Sections 300.430(e) and (f). Further, the proposed remediation goals for Parcel B are protective of human health and the environment and are more stringent and protective than the 100 and 500 millirem per year "dose cap" criteria in 10 CFR Section 20.1403(e). Therefore, the requirements of 10 CFR Section 20.1403(e) have not been carried forward for further analysis as a potential CERCLA federal "applicable or relevant and appropriate requirement" ("ARAR"). Attachment 2, HPS-TMSRARA-IC-ARAR.Doc provides further analysis in support of the Navy's preferred remedial options.

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by San Francisco Health Department and Lennar BVHP, Comments Dated: October 26, 2007	
Comment 5. We agree in general with the concepts in the Navy's proposed language but we propose replacement language to better integrate the Institutional Controls for potential radionuclides with the prior proposed Parcel B IC language. Our proposed new language for inclusion with the other Parcel B IC language is as follows: Activity Restrictions Relating to Area Requiring Institutional Controls (ARIC) for Potential Radionuclides The following land use restriction requirements shall apply in the ARIC for Potential Radionuclides located on IR Sites 7 and 18 and the deep sump under Building 140. At the time of transfer, the areas that require this restriction will be surveyed to define the legal metes and bounds for inclusion in the property transfer documents. The Parcel B RMP shall address any necessary additional soil and radiological management issues within the ARIC for Potential Radionuclides as designated in the property transfer documents. For excavations at IR Sites 7 and 18 that are solely in clean fill, e.g. the fill that is placed above the physical or visual barrier (the	**Response 5.** The requested language has been included in the TMSRA RA after minor changes coordinated with City and Lennar counsel. Please see Attachment 2 attachment A (Institutional Controls in General)

Reviewed by San Francisco Health Department and Lennar BVHP,
Comments Dated: October 26, 2007

barrier) which will be placed directly on top of the restricted soils (as detailed in the Remedial Design or other appropriate documents) the Parcel B RMP will list the procedures to be followed to be sure that the barrier is not disturbed or breeched. For any excavation into the IR Sites 7 and 18 restricted soils beneath the barrier, the proposed excavation will be required to be described in a work plan that will include but not be limited to a radiological work plan, soil sampling and analysis requirements, and a plan for off-site disposal of any potential excavated radionuclides by the transferee in accordance with federal and state law. This work plan must be submitted to and approved by one or more Federal Facility Agreement (FFA) Signatories in accordance with procedures (including dispute resolution procedures) and timeframes that will be set forth in the RMP. The integrity of the cover/cap remedy must be restored upon completion of excavation as provided by the Parcel B RMP. A completion report describing the details of the implementation of the work plan, the sampling and analysis, the off-site disposal and the restoration of the cover/cap must be submitted to and	

RESPONSE TO COMMENTS FOR DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT RADIOLOGICAL ADDENDUM DATED: SEPTEMBER 25, 2007 PARCEL B, HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA DCN: ECSD-2201-0006-0074	
Reviewed by San Francisco Health Department and Lennar BVHP, Comments Dated: October 26, 2007	
approved by one or more Federal Facility Agreement (FFA) Signatories in accordance with procedures (including dispute resolution procedures) and timeframes that will be set forth in the RMP. At this time, a deep sump beneath Building 140 is also anticipated to be designated as an ARIC for potential radionuclides. The procedures and approvals that will be required in order to excavate in the ARIC underneath Building 140 will follow the procedure mentioned above.	

SAN FRANCISCO NAVAL SHIPYARD

1951

ATTACHMENT 2

Hunter's Point Shipyard Remedy Selection for IR Sites 7 and 18 in Parcel B: ARAR Status of 10 CFR Section 20.1403(e)

1. Introduction.

The Navy is conducting investigations and remedial clean-up of the Hunter's Point Shipyard ("HPS") site pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA"), as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 United States Code Sections 9601, *et seq.*); the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP")(Title 40 C.F.R. Part 300); the Defense Environmental Restoration Program ("DERP")(10 U.S.C. Section 2701, *et seq.*); and Federal Executive Order 12580, as amended. A Federal Facility Agreement ("FFA") between the the Navy, the United States Environmental Protection Agency ("USEPA"), the California Department of Toxic Substances Control ("DTSC"), and the San Francisco Regional Water Quality Control Board ("RWQCB") was signed in 1991.

Pursuant to these authorities, the Navy has evaluated remedial alternatives for cleanup of HPS Installation Restoration Program ("IR") Sites 7 and 18 in the HPS Parcel B Technical Memorandum in Support of ROD Amendment ("TMSRA") and TMSRA Radiological Addendum ("RA"). IR Sites 7 and 18 are two non-engineered fill areas located in Parcel B of the Hunters Point Shipyard ("HPS"). They were created in the late 1950s when the Navy filled in portions of the San Francisco Bay in order to expand the dry-land surface area of the HPS installation. The City plans for the IR Site 7 and 18 property to be used for open space and recreation.

Chemicals of concern at these sites include heavy metal and metalloid hazardous substances (antimony, zinc, copper, arsenic, lead, vanadium, iron, mercury, manganese) and organic hazardous substances (benzo(a)pyrene, heptachlor epoxide, dieldrin, bis(2-ethylhexyl)phthalate, benzo(a)anthracene, arochlor-1260, arochlor-1254, dibenz(a,h)anthracene, beta-BHC, benzo(b)fluoranthene, benzo(k)fluoranthene, and naphthalene). The radionuclide hazardous substance of concern at these sites are radium-226, plutonium-239, cesium-137, and strontium-90 (see "Hunters Point Shipyard Final Historical Radiological Assessment" ("HRA")(2004)).

The Navy intends to propose a containment remedy for IR Sites 7 and 18 ("the proposed containment remedy") in a Draft Proposed Plan to be submitted to the FFA Signatories. The proposed containment remedy consists of an engineered soil cap protected by institutional controls ("ICs") and is based upon the remedial alternatives set forth in the Parcel B TMSRA (Alternatives S4 and S5) and TMSRA RA (Alternatives R2 and R3). See Section 2 below for more specific description of the proposed containment remedy. The proposed remedy is consistent with the City of San Francisco's current plans for future open space and recreational use.

The Navy solicited comments on the Draft Final TMSRA RA report, including the proposed ARARs, from the FFA signatories. The California Department of Toxic Substances Control ("DTSC") submitted comments to the Navy dated October 31, 2007, that were prepared by the California Department of Public Health ("DPH"). DPH stated in those comments that DPH could not concur with a "restricted release" pursuant to 10 CFR Section 20.1403(e) for IR Sites 7 and 18 at that time. The "Criteria for License Termination Under Restricted Conditions" ("restricted release") provisions at 10 CFR Section 20.1403(e) set forth Nuclear Regulatory Commission ("NRC") criteria for termination of NRC licenses under restricted conditions for residual radioactivity.

2. Description of the Proposed Containment Remedy.

The proposed containment remedy for IR Sites 7 and 18 includes the following components:

-Survey, removal, and off-site disposal of any detectable radionuclide contamination from the top 12 inches on the surface of the sites exceeding the Remediation Goals ("RGs"),

-An engineering control consisting of a two-foot-thick layer of clean soil ("soil cap") placed on top of a demarcation layer (durable fence mesh demarking the bottom of the two foot soil cap),

- ICs consisting of legally enforceable land use control mechanisms prohibiting certain land uses and activities that could breach or impair the integrity of the "soil cap" or result in unacceptable exposure of the public to buried hazardous substances including radionuclides (see below for specifics), and

-Actions to comply with Federal and State ARARs for "soil cap" design and for long-term "operation and maintenance" to preserve the integrity of the soil cap (i.e., the design, operation, and maintenance substantive standards at Cal. Code Regs. tit. 22, Sections 66264.310(a)(5), (b)(1) and (4) and. Cal. Code Regs. tit. 27, Sections 21090(b)(1) and (c)(4), 21140, 21145(a), and 21150).

-IC implementation and maintenance actions including annual inspections, reports, and enforcement.

The ICs will consist of the following elements which are described in more detail in Section 4.3.2.1 of the Parcel B TMSRA and Section 4.4.1.2 of the TMSRA RA (See **Attachments 2.A and 2.B**):

a. Identical land-use and activity restrictions will be incorporated into environmental restrictive covenants to be included in both Quitclaim Deed(s) issued by the Navy to the property transferee and a Land Use Covenant ("LUC") entered into

between the Navy and DTSC. These environmental restrictive covenants will "run with the land" and be legally binding and enforceable against future transferees in perpetuity.

b. Incorporating identical land-use and activity restrictions into both the Deed(s) and into the DTSC LUC will establish and support a "layered" IC enforcement strategy which would ensure that future transferees comply with the restrictions. More specifically, the restrictions incorporated into the Deed(s) will be enforceable by the Navy, and the restrictions incorporated into the DTSC LUC will be enforceable by DTSC. This enforcement redundancy will help ensure that the land use and activity restrictions are enforced and complied with by future transferees in perpetuity. (Note: DTSC has indicated that the DPH could also sign and independently enforce the restrictions in the LUC.)

c. Land-use restrictions incorporated into the restrictive covenants in the Navy Deed(s) and DTSC LUC will include requirements restricting specified land uses (e.g., prohibition on residential use unless approved by specified regulatory agencies). These restrictions are consistent with the City of San Francisco's plans for future open space and recreational use of Sites 7 and 18.

d. Activity restrictions incorporated into the Navy Deed(s) and DTSC LUC will identify specific activities (e.g., excavation through or other disturbance of the soil cap) that must be reviewed and approved by appropriate federal and state regulatory agencies as provided in a Risk Management Plan ("RMP") which will also be referenced and incorporated into the Deed(s) and the DTSC LUC. The RMP shall address radiological management requirements for potential radionuclides. In order to ensure that federal and state requirements applying to management of radiological materials are complied with, a radiological work plan approved by one or more FFA signatories will be required prior to any excavation into the IR Sites 7 and 18 soils beneath the demarcation layer in accordance with procedures and timeframes set forth in the RMP (See Attachment B).

e. The Navy must prepare a Land Use Control Remedial Design ("LUC RD") report to be reviewed and approved by the FFA Signatories. These reports will specify periodic inspection frequencies, reporting requirements, and enforcement requirements and specify which organization(s) must undertake them. Annual inspections will be conducted to ensure that ICs are complied with as provided in the LUC RD report. In addition, reports of any activity inconsistent with the restrictions will be required. The LUC RD report will also provide for distribution of copies of the inspection reports to the FFA signatories, property owner, and interested parties.

f. If violations of the IC restrictions are identified, either the Navy or DTSC may initiate legal action to enforce the restrictions. According to DTSC, DPH could also sign and independently enforce the restrictions in the LUC.

3. National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Requirements in General.

The proposed containment remedy complies with the remedy selection provisions of the NCP at 40 CFR Part 300 as required by CERCLA including the "protectiveness" and "long term effectiveness and permanence" requirements of Sections 300.430(e) and (f).

a. Protectiveness.

The proposed containment remedy will comply with the "protectiveness" requirements of Sections 300.430(e)(9)(iii)(A), 300.430(f)(1)(i)(A), and 300.430(f)(1)(ii)(A) of the NCP. The Navy has proposed Preliminary Remediation Goals ("PRGs") for radionuclides of concern (radium-226, plutonium-239, cesium-137, and strontium-90) for Parcel B remedial action in the TMSRA RA as provided by Section 300.430(e)(2) of the NCP. See **Attachment 2.C** (Table 3-2 of the TMSRA RA). It is anticipated that the PRGs will become final Remediation Goals (RGs) in the Parcel B Amended ROD. They are consistent with and generally more stringent than USEPA policy for establishing cleanup levels for radionuclides ("Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination", USEPA OSWER Directive 9200.4-18 (August 22, 1997)).

The proposed containment remedy will achieve the RGs. It will address both chemical and radiological hazardous substances including heavy metals that are not subject to biodegradation or radioactive decay and including less stable radionuclides that decay over time. The surface of the sites will be surveyed to a depth of 12 inches for radiological anomalies prior to installation of the cap and any radionuclides exceeding RGs will be removed and disposed of at an appropriate off-site disposal facility. The soil cap will ensure that there is no exposure and no risk to the public from any hazardous substances which may remain at depth below the cap including radionuclides. The cap will be maintained as provided by specific "O&M" ARARs. Development, implementation, oversight, and enforcement of the proposed ICs as described in Section 2 will preserve the integrity of the cap to ensure continuous and permanent prevention of exposure and risk. This will reduce risk well below the RGs.

ICs will remain in effect as long as necessary to protect human health and the environment as required by CERCLA and the NCP. More specifically, land-use and activity restrictions will remain in effect unless additional remedial action is conducted in the future which will allow for unrestricted use consistent with adequate protection of human health and the environment. IC land-use and activity restrictions can only be modified or terminated if DTSC determines that they are no longer necessary to protect human health or the environment (see Cal. Code Regs. tit. 22 Sections 67391.1(a)(2) and (g)).

Section 121(c) of CERCLA requires that the Navy conduct a review of the effectiveness of the remedy (including ICs) every 5 years. If it is concluded during the 5 year review that an IC has not been effective as a remedy, the remedy will be revised. Section 120(h)(3)(A)(ii)(II) of CERCLA provides that the Navy must "come back" following transfer of the property to conduct additional remedial action found to be necessary to

address contamination attributable to Navy activities if the selected remedy is no longer protective..

The Navy believes that violations of the proposed ICs are unlikely because of the layered oversight and enforcement mechanisms that would be put in-place as described above. Furthermore, the possibility of significant exposure to radiation occurring before a violation of an IC is detected during an annual inspection and subsequently corrected is very remote. Quantifying exposure based upon worst case assumptions is inconsistent with CERCLA and the NCP. See NCP preamble at 55 Fed. Reg. 8710, March 8, 1990.

The NRC acknowledged that CERCLA ICs rely upon inspection frequency in the preamble discussion when 10 CFR Section 20.1403(e) was promulgated: "It is also consistent with the approach for institutional controls used in CERCLA that allows for release of sites without a cap providing there is continuous checking on the status of the controls."(62 Federal Register 39071, July 21, 1997).

b. Long-Term Effectiveness and Permanence.

The Navy has considered the "long-term effectiveness and permanence" of the proposed remedial action as required by Sections 300.430(e)(9)(iii)(C), 300.430(f)(1)(i)(B), and 300.430(f)(1)(ii)(E) of the NCP. The proposed ICs described in Section 2 above will remain in effect as long as they are required for adequate protection of human health and the environment and utilize permanent solutions to the maximum extent practicable.

4. The Requirements of 10 CFR Section 20.1403(e).

The "restricted release" provisions of NRC regulations at 10 CFR Section 20.1403(e) establish maximum value "dose caps" on Total Effective Dose Equivalent ("TEDE") when ICs at a site are "no longer in effect." A "dose cap" of 100 mrem/y is established unless certain additional conditions are satisfied that would support a "dose cap" of 500 mrem/y.

The proposed RGs and remedial action for Parcel B are protective of human health and the environment.. The proposed RGs are more stringent and protective than the 100 and 500 mrem/y "dose cap" criteria in 10 CFR Section 20.1403(e). Therefore, the requirements of 10 CFR Section 20.1403(e) have not been carried forward for further analysis as a potential CERCLA federal "applicable or relevant and appropriate requirement" ("ARAR").

4.3.2.1 Evaluation of Applicable Soil Process Options

*****

Institutional Controls in General

Institutional controls are legal and administrative mechanisms used to implement land use restrictions that are used to limit the exposure of future landowner(s) and/or user(s) of the property to hazardous substances present on the property, and to ensure the integrity of the remedial action. Institutional controls are required on a property where the selected remedial clean-up levels result in contamination remaining at the property above levels that allow for unlimited use and unrestricted exposure. Institutional controls would likely remain in place unless the remedial action taken would allow for unrestricted use of the property. Implementation of institutional controls includes requirements for monitoring and inspections, and reporting to ensure compliance with land use or activity restrictions.

Legal mechanisms include proprietary controls such as restrictive covenants, negative easements, equitable servitudes, and deed notices. Administrative mechanisms include notices, adopted local land use plans and ordinances, construction permitting, or other existing land use management systems that are intended to ensure compliance with land use or activity restrictions.

The Navy has determined that it will rely upon proprietary controls in the form of environmental restrictive covenants as provided in the "Memorandum of Agreement Between the United States Department of the Navy and the California Department of Toxic Substances Control" and attached covenant models (Navy and DTSC 2000) (hereinafter referred to as "Navy/DTSC MOA"). Appendix G contains the Navy/DTSC MOA.

More specifically, land use and activity restrictions will be incorporated into two separate legal instruments as provided in the Navy/DTSC MOA:

1. Restrictive covenants included in one or more Quitclaim Deeds from the Navy to the property recipient.

2. Restrictive covenants included in one or more "Covenant to Restrict Use of Property" entered into by the Navy and DTSC as provided in the Navy/DTSC MOA and consistent with the substantive provisions of Cal. Code Regs. tit. 22 § 67391.1.

The "Covenant(s) to Restrict Use of Property" will incorporate the land use restrictions into environmental restrictive covenants that run with the land and that are enforceable by

DTSC against future transferees. The Quitclaim Deed(s) will include the identical land use and activity restrictions in environmental restrictive covenants that run with the land and that will be enforceable by the Navy against future transferees.

The activity restrictions in the "Covenant(s) to Restrict Use of Property" and Deed(s) shall be implemented through the Parcel B Risk Management Plan ("Parcel B RMP") to be prepared by the City of San Francisco and approved by the Navy and FFA Signatories. The Parcel B RMP shall be discussed in the Parcel B ROD amendment and shall be attached to and incorporated by reference into the Covenant(s) to Restrict Use of Property and Deed(s) as an enforceable part thereof. It shall specify soil and groundwater management procedures for compliance with the remedy selected in the Parcel B ROD amendment. The Parcel B RMP shall identify the roles of local, state, and federal government in administering the Parcel B RMP and shall include, but not be limited to, procedures for any necessary sampling and analysis requirements, worker health and safety requirements, and any necessary site-specific construction and/or use approvals that may be required.

In addition to being set forth in the Covenant and Deed(s) as described above, restrictions applied to specified portions of the property will be described in findings of suitability for transfer and findings of suitability for early transfer.

Access

The Deed and Covenant shall provide that the Navy and FFA Signatories and their authorized agents, employees, contractors and subcontractors shall have the right to enter upon HPS Parcel B to conduct investigations, tests, or surveys; inspect field activities; or construct, operate, and maintain any response or remedial action as required or necessary under the cleanup program, including but not limited to monitoring wells, pumping wells, treatment facilities, and cap/containment systems.

Implementation

The Navy shall address/describe institutional control implementation and maintenance actions including periodic inspections and reporting requirements in the preliminary and final remedial design (RD) reports to be developed and submitted to the FFA Signatories for review pursuant to the FFA (see "Navy Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions" attached to January 16, 2004 DoD memorandum titled "Comprehensive Environmental Response, Compensation and Liability Act [CERCLA] Record of Decision [ROD] and Post-ROD Policy"). The preliminary and final RD reports are primary documents as provided in Section 7.3 of the FFA.

Activity Restrictions that Apply Throughout Parcel B

The following sections describe the institutional control objectives to be achieved through activity restrictions throughout Parcel B in order to ensure that any necessary measures to protect human health and the environment and the integrity of the remedy have been undertaken.

Restricted Activities

The following restricted activities throughout HPS Parcel B must be conducted in accordance with the "Covenant(s) to Restrict Use of Property", Quitclaim Deed(s), the Parcel B RMP, and if required, any other work plan or document approved in accordance with these referenced documents:

a. "Land disturbing activity" which includes but is not limited to: (1) excavation of soil, (2) construction of roads, utilities, facilities, structures, and appurtenances of any kind, (3) demolition or removal of "hardscape" (for example, concrete roadways, parking lots, foundations, and sidewalks), (4) any activity that involves movement of soil to the surface from below the surface of the land, and 5) any other activity that causes or facilitates the movement of known contaminated groundwater.

b. Alteration, disturbance, or removal of any component of a response or cleanup action (including but not limited to pump-and-treat facilities, revetment walls and shoreline protection, and soil cap/containment systems); groundwater extraction, injection, and monitoring wells and associated piping and equipment; or associated utilities.

c. Extraction of groundwater and installation of new groundwater wells.

d. Removal of or damage to security features (for example, locks on monitoring wells, survey monuments, fencing, signs, or monitoring equipment and associated pipelines and appurtenances).

Prohibited Activities

The following activities are prohibited throughout HPS Parcel B:

a. Growing vegetables or fruits in native soil for human consumption.

b. Use of groundwater.

Activity Restrictions Relating to VOC Vapors at Specific Locations within Parcel B.

Any proposed construction of enclosed structures must be approved in accordance with the "Covenant to Restrict Use of the Property," Quitclaim Deed, and Parcel B RMP prior to the conduct of such activity within the area requiring institutional controls (ARIC) for VOC vapors in order to ensure that the risks of potential exposures to VOC vapors are reduced to acceptable levels that are adequately protective of human health. Initially, the ARIC will include all of Parcel B except Redevelopment Block 4. This can be achieved through engineering controls or other design alternatives that meet the specifications set forth in the ROD amendment, RD reports, land use control remedial design (LUC RD) report, and Parcel B RMP. The ARIC may be modified by the FFA Signatories as the soil contamination areas and groundwater contaminant plumes that are producing unacceptable vapor inhalation risks are reduced over time or in response to further soil, vapor, and groundwater sampling and analysis for VOCs that establishes that areas now included in the ARIC do not pose an unacceptable potential exposure risk to VOC vapors.

Additional Land Use Restrictions for IR Sites 7 and 18

The following restricted land uses for property in IR Sites 7 and 18 must be reviewed and approved by the FFA Signatories in accordance with the "Covenant(s) to Restrict Use of the Property," Quitclaim Deed(s), and Parcel B RMP prior to use of the property for any of the restricted uses:

a. A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation,

b. A hospital for humans,

c. A school for persons under 21 years of age, or

d. A day care facility for children.

Attachment 2.B

4.4.1.2 Institutional Controls

The following activity restriction requirements shall apply in the Area Requiring Institutional Controls (ARIC) for potential radionuclides located on IR Sites 7 and 18 and the deep pump shaft under Building 140 (see Figure 2-3) in addition to those generally applicable land use restrictions specified in Section 4.3.2.1 of the TMSRA. At the time of transfer, the areas that require this restriction will be surveyed to define the legal metes and bounds for inclusion in the property transfer documents.

The Parcel B Risk Management Plan (RMP) described in the TMSRA, Section 4.3.2.1 (Sultech, 2007) shall address any necessary additional soil and radiological management issues within the ARIC for potential radionuclides designated in Figure 2-3 and defined in the property transfer documents.

For excavations at IR Sites 7 and 18 that are solely in clean fill, e.g. the fill that is placed above the physical or visual barrier (the barrier) which will be placed directly on top of the soils as detailed in the Remedial Design or other appropriate documents, the Parcel B RMP will list the procedures to be followed to be sure that the barrier is not disturbed or breeched. No radiological sampling and analysis will be required for excavations that are solely in clean fill.

For any excavation into the IR Sites 7 and 18 soils beneath the barrier, the proposed excavation will be required to be described in a work plan that will include but not be limited to a radiological work plan, soil sampling and analysis requirements, and a plan for off-site disposal of any excavated radionuclides by the transferee in accordance with federal and state law. This work plan must be submitted to and approved by one or more Federal Facility Agreement (FFA) Signatories in accordance with procedures (including dispute resolution procedures) and timeframes that will be set forth in the RMP. The integrity of the cover/cap must be restored upon completion of excavation as provided in the Parcel B RMP. A completion report describing the details of the implementation of the work plan, the sampling and analysis, the off-site disposal, and the restoration of the integrity of the cover/cap must be submitted to and approved in writing by one or more Federal Facility Agreement (FFA) Signatories in accordance with procedures (including dispute resolution procedures) and timeframes that will be set forth in the RMP."

Attachment 2.C

HUNTERS POINT SHIPYARD REMEDIATION GOALS

Radionuclide	Surfaces[g] (dpm/100 cm^2)		Soil[c g] (pCi/g)		Water[e g] (pCi./L)
	Equipment, Waste[a]	Structures[b]	Construction Worker	Residential	
cesium-137	5,000	5,000	0.113	0.113	119
cobalt-60	5,000	5,000	0.0602	0.0361	100
plutonium-239	100	100	14.0	2.59	15
radium-226	100	100	1.0[d]	1.0[d]	5.0[f]
strontium-90	1,000	1,000	10.8	0.331	8

Notes:

[a] These objectives are based on AEC *Regulatory Guide 1.86* (1974). Objectives for removable surface activity are 20 percent of these values.

[b] These objectives are based on 25 mrem/y.

[c] EPA PRGs for two future-use scenarios.

[d] Objective is 1 pCi/g above background per agreement with EPA.

[e] Release criteria for water have been derived from *Radionuclides Notice of Data Availability Technical Document,* (EPA, 2000) by comparing the limits from two criteria and using the most conservative limit.

[f] Limit is for total radium concentration.

[g] Taken from *Revised Final Basewide Radiological Removal Action, Action Memorandum.* Hunters Point Shipyard, San Francisco, California. February 14, 2006.

AEC – Atomic Energy Commission
cm^2 -- square centimeter
dpm – disintegration per minute
EPA – U.S. Environmental Protection Agency
mrem/y – millirem per year
pCi/g – picocurie per gram
pCi/L – picocurie per liter
PRG – Preliminary Remediation Goal